THE

ELECTRICAL REVIEW.

VOL. LXXXIII. NOVEMBER 15, 1918. No. 2,138.

ELECTRICAL REVIEW.

Vol. LXXXIII.] CONTENTS: November 15, 1918. [No. 2,138.

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THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. Established 1872.

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY

OFFICE:—4, LUDGATE HILL, LONDON, E.C. 4.

Telegraphic Address: "AGENRAY, CENT., LONDON." Code, A B C
Telephone Nos.: City 977; Central 4425 (Editorial only).

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

Subscription Rates.—Per annum, postage inclusive, in Great Britain, £1 1s. 8d.; Canada, £1 2s. 10d. ($5.80). To all other countries, £1 10s.

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WELLINGTON, N.Z.: Gordon & Gotch, Cuba Street.

Cheques and Postal Orders (on Chief Office, London) to be made payable to THE ELECTRICAL REVIEW, and crossed "London City and Midland Bank, Newgate Street Branch."

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THE ARMISTICE.

"How are the Mighty Fallen!" At last—after fifteen hundred and more days and nights of deadly struggle—the tyrants of Prussianism have been hurled from their seats! Their strong sword has been broken in their hand; their mailed fist, battered and bleeding, carries instead a white flag suing for Peace.

An Armistice concluded in terms which will hardly permit of renewal of hostilities was signed in the early morning hours of Monday, November 11th. Before the midday hour fighting on all fronts had ceased. Thus was Peace restored to our tortured world.

The menace which has threatened Christian civilisation and the rights of all men everywhere for the greater part of a generation has been destroyed. The record of its failure through destruction is written in blood for all succeeding generations to take heed that militarism does not pay.

To destroy that menace a colossal price in lives and treasure has been paid by most of the civilised nations of the earth. In August, 1914, in fiery anger at Britain's determination to enter the war, the Kaiser, with his accustomed contemptuous scorn, asked whether we had counted the cost. Howsoever that may be, we have not shrunk from any sacrifice. The cost to the Allies has been immense, but that to the aggressor has been, and will be, larger far. Nemesis has followed the wrongdoer, and the Wrath of Heaven now pours forth mercilessly. Right and Might combined have defeated Might and Wrong. Prince Max of Baden has filled his *rôle* in the great drama. He came upon the stage to prepare the way for Peace; and as he passes out again into oblivion, words are upon his lips which will become historic:—

Germany has won a Victory over itself and its belief in the right of might.

Has the struggle been worth while? Millions of promising lives sacrificed; many millions broken in body; tens of millions distressed in mind, body, or estate. Fifteen hundred days of more than half a world wasted in the destructive arts of war. Was it all worth while? Even the very spirits of our dead will answer that it was—yes, well worth while—for the future has been saved for an entire world: fifteen hundred million lives of to-day and untold millions who will follow.

Might is for ever broken, we trust; respect for Right for ever enthroned, we pray. Torn out by the deepest roots is the cancer that threatened all existence that would not bow the knee to the Idol of World Power. The downfall of that idol having been secured, we are free to tread again the almost forgotten paths of Peace, and devote ourselves to more congenial avocations. But those paths require re-making; those avocations will be pursued in an altered atmosphere. 'Twere fatal to ignore these two essentials to-day.

The feelings of deep satisfaction that the issue brings us all is finding expression in justifiable rejoicing. The bells of St. Paul's Cathedral are ringing as we write, and from ten thousand throats there issue shout and song. Our pent-up feelings have waited for relief. Now shall we all give praise to God.

It is inevitable that the world's rejoicing should be mingled with the poignancy of grief. Chastened by sense of loss, yet not unconscious of the glory of achievement, we permit our laughter and our cheers to smother our tears and choke our deep emotion. We will reverently remember in loosening our restraint that vast army of men by whose supreme sacrifice the Victory has been won—the great company that has passed on to the heritage of the Spiritual Silence beyond. Soon our Conquering Heroes, lately so valiantly beating back the foe, will be returning, but these others hear the grand acclaim from Higher Powers. They

have received their reward, but they brood o'er us, and we shall not forget them and the price they paid. They have died for us that we might live in greater freedom. Yet may we not say that even for them it has been worth while?

They climbed the steep ascent to Heaven.

And there are those—many of them readers of these lines—who sit alone in sorrow. The very centre of their hopes, their plans in life, four years ago, is gone. An unseen hand came forth and crumpled up the plans upon which they spent such fond affection, and left in place thereof the destiny that these should help to win the Victory. We will remember the brave, proud sorrowing ones.

What of ourselves and Peace? History alone, and that after many years of mature observation and judgment, will record how revolutionary the effects of the times have been upon the life, thought, and character of the nations. The hours are vibrant with wondrous possibilities if we go forward in the spirit of our heroes. May we prove worthy of them all, and of the grand inheritance that through these great events Providence has willed as ours.

THE KELVIN LECTURE.

On Thursday last week, at the opening meeting of the new session of the Institution of Electrical Engineers, we heard with fascinated interest the tenth Kelvin Lecture, which was delivered by Mr. Llewelyn B. Atkinson. The lecturer chose for his subject certain theorems presented to the world by Lord Kelvin—then Prof. William Thomson—in 1853, relating to the energy associated with every distribution of electricity, magnetism, or electric currents, which had lain practically dormant until now. The more we learn of the work accomplished by Lord Kelvin, and of the extraordinary range and thoroughness of his investigations in electrical science, the more we are amazed at the extent of his genius, thankful that he lived in the days when that science was practically virgin soil, and proud to claim him as one of the most eminent of our fellow-countrymen. Moreover, even if he had never engaged in electrical research, his achievements in other branches of physics would have sufficed to ensure his everlasting renown as a scientist of the first rank, a fact which intensifies our admiration of his gigantic intellect.

The original theorem demonstrated that the electrification of a conductor, the magnetisation of a substance, and the flow of an electric current, each represented a definite amount of energy of which the value could be calculated. The lecturer, with consummate ability and originality, discussed the meaning of this statement and its bearing upon practical working conditions. He examined each case exhaustively, analysed the conditions, and classified the results clearly, his remarks being illustrated by a large number of diagrams and a few simple models. Unfortunately, it was impossible in the time available for him to read the whole of the address, which, moreover, is too long and detailed for reproduction in our columns whilst the scarcity of paper under which we labour continues; but enough was imparted to achieve one object of the lecture—namely, to stimulate the investigation of electrical problems from a new point of view—and abundantly to justify the claim of the author that there are "wide fields for new designs and experiments," the cultivation of which may lead to new departures of which no one can foresee the limitations.

Listening to the author's admirably lucid and masterly exposition of a subject which in other hands might have been rendered abstruse and tedious to the last degree, we were irresistibly reminded of that other paper which Mr. Atkinson read in 1898, when he gave the outline theory of almost every type of alternating-current motor that has since been developed and brought into practical use. Probably few of our readers are acquainted with that paper—a paper which, in view of subsequent developments, was of the first importance, and should have been made available to every electrical engineer. Unfortunately, it was read before the Institution of Civil Engineers, and was, therefore, entombed in the official *Proceedings* of that body, which does not permit the Press to reprint the papers read at its meetings. Now Mr. Atkinson has again rendered a great service to the industry by directing its attention to some of the unexplored possibilities which lie before it. Amongst these are included the development of an efficient electrostatic ignition machine to take the place of the magneto, a reciprocating electric motor, and possible improvements in variable-speed motors, and in generators. As regards the first of these, we have on several occasions drawn attention to the pressing need for a direct-current generator capable of developing a very high pressure—from 50,000 to 100,000 volts—for use in connection with radiography, agriculture, the precipitation of dust, testing cables, &c., and, in view of the little progress that has so far been made in the evolution of electrostatic generators of the frictional and influence types, we agree with Mr. Atkinson that there is plenty of room for invention along these lines, to which his clear generalisations should afford great assistance. But this is only one of the many directions in which progress is possible, to which the tenth Kelvin Lecture may be expected materially to contribute, and we offer hearty congratulations to the author on his presentation of an excellent lecture, which will take its place amongst the classics of electrical literature.

Hints to New Zealand Traders.

On another page space is devoted to certain portions of the report of H.M. Trade Commissioner in New Zealand (Mr. R. W. Dalton), which deals with Great Britain's position in the machinery trade of that Dominion, and also describes certain developments bearing upon future trade in that line. The possibilities in connection with hydro-electric enterprise are especially worthy of study. It is clear that if this country is to succeed in taking a proper share of prospective business in machinery in the Dominion, no time must be lost in recovering the ground left behind during the war, and that to do this effectively a greater and better organised effort will have to be made than British manufacturers have ever before embarked on in that market.

Mr. Dalton considers that the British manufacturer, prior to establishing trading relations, fails to make sufficiently careful investigations, and he specifies the electrical machinery trade as constituting an example of this faulty method. It is of no use for an exporter supplying articles for which there is a large and scattered demand to attempt to operate on the New Zealand market exactly in the same way as one supplying goods the trade in which is small and concentrated.

Writing at a time when peace could scarcely be considered as within sight, Mr. Dalton recommended manufacturers to complete their agency arrangements, even with the mutual knowledge that actual deliveries of goods could not be contemplated. Now, however, that hostilities have ceased, this recommendation becomes of vital urgency. There are many good firms in New Zealand who are anxious to complete their agencies by adding one or two new lines; but they cannot be expected to wait indefinitely, and there are not so many of them that we can afford to have them place their services at the disposal of our competitors.

There is need, too, for British firms to be more liberal in their treatment of their representatives. American principals have for some time held a vastly better reputation in this respect than we have, and on top of this we have latterly been subjected to criticism on the score of neglect of our old agents who have remained loyal to us during the war, when business was at a standstill, and, consequently, commission was not forthcoming.

Not a few British manufacturers and traders have had the opportunity of testing the soundness of Mr. Dalton's judgment in matters of export trade generally. There is now an opportunity of consulting him about the New Zealand market, as he is on a visit to this country, and invites callers to see him (by appointment) at the Department of Overseas Trade, 73, Basinghall Street, E.C.

Electricity-Supply Restrictions.

In our "Notes" to-day will be found the text of a new Order issued by the Ministry of Munitions with regard to the supply of electricity. A careful comparison with the terms of the Household Fuel and Lighting Order which was issued in the summer shows that the new edict is more precise and comprehensive than the former; it applies only to electricity, and forbids the making of new connections, the giving of new supplies, and the *use* of electricity for any such purposes. It, therefore, now makes the consumer himself responsible for the observance of the rule, whereas the previous Order applied only to supply undertakers and contractors. It also covers *all* uses of electricity, whilst the former dealt only with lighting and heating. Moreover, it entrusts the power of granting permits for the relaxation of the regulation to the Director of Electric Power Supply, who is thus armed with power to veto every new application for the use of electricity. While it by no means follows that permits will be unreasonably withheld, this further extension of the Director's already extremely wide powers will not be regarded without concern. That there is a certain amount of unrest in electrical circles with regard to the situation as it relates to the grants of permits for the extension of electricity works under the present *régime* is indicated by the circular of the I.M.E.A. to Members of Parliament, which was published in our last issue, and it will probably find expression in the House of Commons before very long.

The terms of the circular are rather remarkable; it will be noticed that the Association claims to represent "practically the whole of the electricity supply undertakings in Britain"! With all due respect to the Association, whose importance we fully appreciate, we cannot admit the validity of this statement. According to the Board of Trade Committee's Report, in 1916, there were 327 local authorities and 230 companies operating undertakings under statutory authority, the capital expenditure in the former case being 55 millions, and in the latter 36 millions sterling; hence the claim of the Association, even if its membership embraced the whole of the municipal undertakings, would appear to be somewhat exaggerated. Moreover, it is within our knowledge that enormous additions have been made to municipal power stations during the war—extensions which, when fully disclosed, will astonish the reader—and, in the absence of particulars, we are at a loss to know in what the "lack of uniformity of treatment" that is complained of consists. The Director has an exceedingly difficult office to fill, and his decisions must necessarily have regard to all the conditions to which the war has given rise, and which cannot be equally familiar to his critics. The fact remains, however, beyond dispute that dissatisfaction exists in certain quarters, and if it be not allayed, the success of the scheme for national electricity supply may be seriously jeopardised. It appears, therefore, that the appointment of the Board of Electricity Commissioners is a matter of extreme urgency; it will not do for the Board of Trade to delay action until its scheme has reached maturity—the situation is developing with great rapidity, and the importance of the question cannot be exaggerated. Demobilisation will shortly commence, and the change-over from the manufacture of munitions to industrial production has already begun. We therefore feel bound to urge the Board of Trade, with all the emphasis at our command, to lose not another hour in pressing forward the national scheme, and, as a first step, to set up the Board of Electricity Commissioners at once, even though it be necessary to pass a short Act of Parliament to provide it with authority for this purpose.

The importance of immediate action will be better understood when we add that it has come to our knowledge that directly hostilities came to an end a circular letter was addressed by the Ministry of Munitions to all the supply undertakings of this country, inviting them to forward particulars of any extensions of plant and mains that they might have in view, especially such as were unavoidably postponed during the war, in order that urgent requirements might be met as far as possible. The establishment of a controlling authority, or at least an advisory body, to co-ordinate all such extensions in accordance with the national interests is therefore a matter of the utmost urgency.

Provisional Orders.

In view of the prospective reorganisation of the electric supply industry, and of the fact that the bulk of such supply is given under Provisional Orders, it may be of interest to review briefly the position in this respect as it is to-day.

A supply of electricity to the public is given either by a statutory or a non-statutory undertaking. The non-statutory undertakings are practically negligible; they are small and unimportant, and would number, say, about 70 or 80.

As regards the statutory undertakings, the legal authority for these may be either a Licence, a Special Act, or a Provisional Order. The first method has long been a dead letter; no licences have been granted since 1902, and only 33 licences have been granted altogether, none of which are now in force.

As regards the undertakings working under Special Acts, these are mainly power companies or undertakings which have combined their electricity supply with gas or tramway undertakings.

The remaining class of statutory undertaking, and the procedure most favoured, is that of the "Provisional Order," and it is under such provision that the bulk of the capital invested in electricity supply has been expended.

The number of Provisional Orders in force in 1915 was 881—56 in London and 825 in other parts of the kingdom. Of the total of Provisional Orders, 425 are in the hands of local authorities and 456 in the hands of companies or private individuals. For some years past, all important areas have been already covered by Provisional Orders, so that although a good many Orders appear from year to year, these, in the main, are either for small towns or for areas where there is some prospect of industrial or other development, or for extensions of existing Orders.

The total capital expended under Provisional Orders and Acts (company and municipal) is about 91 million pounds, the bulk of this being, of course, expended under Provisional Orders.

Since the outbreak of war a good number of applications have been made for Provisional Orders, but these are at present hung up, pending legislation on the lines of the Board of Trade Electric Power Committee's Report. Among such applications are a certain number which have been formally granted, but they are rendered inoperative by the insertion of a clause leaving the date open on which the Order shall come into force. The few cases which have been completely granted have each had some special circumstances which justified their exceptional treatment.

The B. of T. Electric Power Committee's Report contains one or two points of interest with regard to Provisional Orders. It takes cognizance of the position of the non-statutory companies, and considers that these should be put on a legal basis. In order to do this at a small cost, it recommends that any new Provisional Orders authorising the supply of electricity to areas of a population of less than 5,000 should not require confirmation by Parliament.

The Report is also in favour of the procedure by way of Provisional Order being simplified, as recommended by the Sub-Committee of the Ministry of Reconstruction presided over by Sir George Murray—namely, the Acquisition of Powers Sub-Committee. This Sub-Committee was appointed to consider the question of reducing the cost and simplifying the process of obtaining Parliamentary powers. Incidentally, the Sub-Committee refers very favourably to the procedure regarding Provisional Orders as administered under the Electric Lighting Acts. But the point in this Report which is of particular interest in the present connection is the recommendation that Parliament should be willing to authorise that any Provisional Order which was unopposed might be allowed to take effect without further Legislative enactment, after having been laid before Parliament for the prescribed period.

THE CHARACTERISTICS OF THE COMMUTATOR AMPERE-HOUR METER.

By G. W. STUBBINGS.

The commutator ampere-hour meter formed the subject of a good deal of discussion some years ago, and very varied opinions as to its performance were expressed. On the one hand, curves were published as representing the average performance of meters of this class which were so bad as to make it surprising that the meters had any sale at all. On the other hand, the advocates of this meter confidently predicted for them a hopeful future, and asserted that for small consumers the mercury-type meter would soon be considered obsolete. Neither of these extreme opinions has been justified by subsequent experience. The commutator meter is still used to a considerable extent in this country, and in suitable circumstances has given very satisfactory service. For accurate registration on small loads the commutator meter has not been found to be entirely suitable, on account of the fact that the low-load accuracy, which may be very high when the meter is new, rapidly falls off after the meter has been on circuit for some time. For these requirements the mercury-type meter still holds its own, the commutator meter finding more useful application on circuits where the minimum load is fairly high.

The theory of the commutator meter does not appear to be well understood. The writer has heard it stated that the addition of an eddy-current brake to a meter of this class completely alters the form of the speed-load characteristic. A speaker at the discussion on Messrs. Ratcliffe and Moore's paper on "Electricity Meters," read before the I.E.E. in 1911, stated that for maximum accuracy the sum of the armature and shunt resistances should be made equal to the friction moment, and condemned the practice of designing these meters with a high armature resistance. As these views are more or less misleading, it may be useful to inquire briefly, from a theoretical point of view, into the nature of the characteristics of the commutator meter.

The earliest meters of this class consisted of a small electric motor connected across the terminals of a low-resistance shunt which was placed in the circuit to be metered. As there was no eddy-current brake, when the current was switched on, the armature would commence to rotate, and would accelerate till the armature current was just strong enough to develop sufficient torque to overcome the friction. Denoting the resistance of the armature circuit by R, the resistance of the shunt by r, the total flux by B, the number of turns in the armature by N, the friction torque by f, the currents in the main, shunt, and armature respectively by C, C_s, and C_a, and equating the torque developed in the meter to the friction torque, then—

$$K\,B\,N\,C_a = f,$$

K being a constant. Equating the E.M.F.'s in the shunt and armature circuit—

$$K\,B\,N\,\omega + C_a\,R = C_s\,r,$$

ω being the angular speed of the rotor. Remembering that $C_a + C_s = C$, and eliminating C_a from these equations, we finally obtain—

$$\omega = C\,r/K\,B\,N - f(R + r)/(K\,B\,N)^2.$$

If in this equation f be put equal to zero, the first term will give the speed of the meter under ideal conditions, and the percentage error of the meter will accordingly be given by the equation—

$$\epsilon = -\,100\,\{f(R + r)/K\,B\,N\,C\,r\}.$$

From this equation it is seen that the error is inversely proportional to the load, and the error curve of the meter, therefore, is a rectangular hyperbola. The error at any load will be proportional to the friction and inversely proportional to the flux. Increasing B will, therefore, not only decrease the speed of the meter, but will also decrease its inaccuracy. The effect of varying R and N is not so simple, as these quantities are not necessarily independent. If the weight of copper in the armature windings be constant, the resistance of these windings will then be proportional approximately to N^2. Assuming that in these circumstances f remains constant, it is easy to show that the error is a minimum when the armature resistance is equal to the sum of the resistances of the shunt, and the commutator and brushes. This result is of little practical value, as this condition would, owing to the small value of N, involve an excessive speed. Actually the limiting values of ω/C, B, and r are fixed by practical considerations, thus also fixing the value of N. The value of R will then depend mainly upon the armature weight permissible.

The above expression of the percentage error of the unbraked meter represents its initial inaccuracy only, and not necessarily its inaccuracy after prolonged service. In course of time not only will the friction increase, but the magnets will weaken, and the contact resistance of the brushes will increase. The effect of an alteration in B will be to increase the ideal speed of the meter, and as the meter has been adjusted to read correctly at the former speed, the alteration in calibration will cause an error of registration. As the speed, neglecting the error term, is inversely proportional to the flux, a small percentage change in B will make a similar percentage change in ω. The effect of an alteration in R, due to increased brush friction, will not affect the calibration of the meter, and will only affect the error term. A small percentage increase in R will therefore cause an approximately equal percentage increase in the percentage error, the magnitude of the effect being negligible. An increase of 10 per cent., for instance, in the value of R, will mean that a meter having an error of 3 per cent. will have this error increased to about 3·3 per cent. The comparatively small effect of a change in the contact resistance of the brushes in an unbraked meter is worthy of note.

The speed of the unbraked meter with permanent magnets of ordinary size is very high, and in most meters this speed is reduced by the addition of an eddy-current brake moving in the field of the driving magnet. In meters having a disk-shaped armature, the aluminium casing containing the coils serves as the brake. The effect of the brake is to reduce the speed of the armature till sufficient current flows to develop a torque equal to the sum of the friction and braking torques. Equating these torques, we have, m being a constant depending upon the shape and material of the brake—

$$K\,B\,N\,C_a = f + m\,B^2\,\omega,$$

and

$$K\,B\,N\,\omega + C_a\,R = C_a\,r.$$

Eliminating C_a from these two equations, we finally obtain—

$$\omega = \{K\,B\,N\,C\,r - f(R + r)\}/\{(K\,B\,N)^2 + m\,B^2(R + r)\}.$$

The speed of the meter has thus been reduced, the ratio of the unbraked to the braked speed being—

$$1 + m\,(R + r)/K^2\,N^2.$$

The percentage error of the meter will be—

$$-\,100\,\{f\,(R + r)/K\,B\,N\,C\,r\}.$$

This expression is the same as that obtained for the unbraked meter. The effect of adding the brake has been, therefore, merely to lower the speed, the initial accuracy of the meter remaining the same.

The ideal speed of the braked meter can be written as $K\,N\,C\,r/B\,\{K^2\,N^2 + m\,(R + r)\}$. The effect of a diminution in B, through the gradual weakening of the permanent magnets will be to alter the ideal speed of the meter, and to introduce an error of registration equal to the percentage change in B. It will also be noticed that R, the armature resistance, appears in the expression for the ideal speed. Any change in R, due to increase in brush contact resistance, will therefore alter the calibration of the meter by an amount depending upon the braking effect. The error of registration caused by such alteration of R will, therefore, be appreciable, and for this reason it is necessary in braked meters to have a fairly high armature resistance, in order that a change in the brush contact resistance will produce but a small percentage change in R. In this respect there is then a marked difference between meters of the braked and unbraked types.

It is now well known that a mercury type shunted meter will register accurately on varying loads. Since in the commutator meter the control is partly effected by the back E.M.F. of the armature, the behaviour of the meter on varying loads is worthy of investigation.

If L_s and L_a be the coefficients of self-induction of the shunt and armature circuits respectively, we have, equating E.M.F.'s, for any conditions—

$$C_s r + L_s . d C_s/dt = C_a R + L_a . d C_a/dt + K_1 \omega.$$

Substituting $(C - C_s)$ for C_a, multiplying throughout by dt, and integrating between the limits T_1 and T_2 at each of which times $C = 0$—

$$r Q = (R + r) \int_{T_1}^{T_2} C_s \, dt + K \theta,$$

where Q is the total quantity of electricity that has passed, and θ is the angle turned through by the armature. The equation of motion of the moving element can be written, I being its moment of inertia—

$$b C_s = m_1 \omega + I . d \omega/dt.$$

Multiplying by dt, and integrating as before between T_1 and T_2 at each of which times the armature is at rest—

$$\int_{T_1}^{T_2} C_s \, dt = m_1 \theta/b.$$

Combining the second and fourth equations of this paragraph—

$$Q = \theta \{K_1/r + m_1 (R + r)/b r\};$$

and this equation is precisely similar to that which would be obtained on the assumption of a constant current. The commutator meter will, therefore, register accurately on varying loads.

Since the ideal speed of the unbraked meter is $C r/K B N$, by making the shunt of a material of negligible temperature coefficient, the effect of temperature on the accuracy of the meter will be very small, such effect only taking place in the error term. The speed of the braked meter, neglecting the back E.M.F. of the armature can be written as—

$$\omega = K_2 . r \rho/(R + r),$$

where ρ is the volume resistivity of the material of the brake. If α be the resistance temperature coefficient of this material, β that of the armature windings, and n the ratio of armature resistance to shunt resistance, it is easy to show that the temperature coefficient of the meter is—

$$\alpha - \beta . n/(n + 1).$$

As α and β usually apply to copper and aluminium respectively, and $n/(n + 1)$ is nearly equal to unity, this temperature coefficient can be made negligibly small. The effect of the back E.M.F. of the armature will be to cause an apparent increase of n. The above approximate value is thus worse than the actual value.

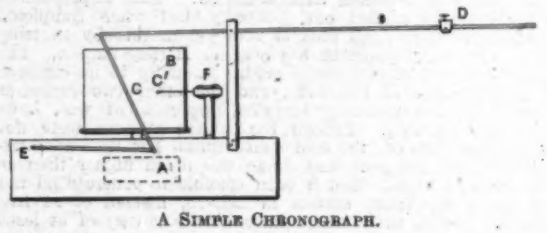
A SIMPLE CHRONOGRAPH.

By C. W. MARSHALL.

It is now generally recognised to be essential for all electricity supply undertakings to have accurate data as to the characteristics of their oil switches. Data regarding new switches can be obtained from the manufacturers, but older types must be investigated by their owners. The apparatus described has been found very serviceable, and can be thoroughly recommended as a cheap and reliable article. Practically no skill is required either to build or to operate it. Referring to the figure, A is a gramophone motor, such as can readily be purchased second-hand for a few shillings, B is a drum taken from an obsolete recording ammeter, and fitted on the gramophone record turntable; C D E is a three-element lever system. The long arm is made in sections, for convenience in transport. When testing the speed of a switch, the sliding saddle D is connected to a convenient point on the switch mechanism, and the length of the lever is adjusted so as to give a suitable travel to the recording pencil which is at C.

The drum is then set to revolve at a speed commensurate with that of the apparatus under test, and "opening" and "closing" curves of the switch can be taken as required. Experience has shown that a drum peripheral speed of 50 cm./sec. gives excellent results with the usual types of oil switch; but even a very cheap motor will drive the drum at 500 cm./sec. if necessary. A very gratifying feature of the motor is its constancy in speed over long intervals, and cyclic irregularities are quite negligible. This renders it quite unnecessary to fit any additional apparatus to mark the time-co-ordinates directly on the record except in specially important cases. In such cases the ingenious appliances described by Dr. Garrard in a recent paper to the I.E.E. could be used. Metallic paper is generally used in conjunction with a silver point, and the records obtained in this way are very satisfactory. The paper is fitted on the drum by two rubber bands, one being at the top and the other at the bottom.

The apparatus could be made more compact if spiral records were considered allowable, as the charts could be put directly on the gramophone turntable. The form



A Simple Chronograph.

described is, however, somewhat more convenient when space-time curves are being differentiated to give velocity-space curves.

The fitting shown at F is used for determining the times of action of relays, fuses, &c. The fuse, for example, is connected in series with the energising coil of the electromagnet. When the current is switched on, the pencil C' comes into contact with the revolving drum, and when the current is interrupted by the blowing of the fuse, C' leaves the paper. The length of the line is a measure of the time taken to blow the fuse. For convenience in obtaining "fusing-current" "time" curves, the height of F is variable.

PROPOSED EXTENSIONS AT STOKE-ON-TRENT.

The County Borough Council on October 30th considered Sir John Snell's report, to whom had been referred the Electricity Committee's proposal to spend £110,000 on extending the central power station. The report dealt with (1) the cause of the annual deficit in the working of the electricity department; (2) the necessity or otherwise of the proposed extension of the central power-house and of the proposed H.T. main to the Denbigh Castle; (3) the proposal to add a uniform percentage to both lighting and power rates, and whether some differentiation should be made between the two classes of supply; (4) the future position of Stoke arising from the probable action to be taken throughout the country as a result of the report of the Electric Power Supply Committee of the Board of Trade; (5) the Corporation's relations with the tramway undertaking. The position was rendered more complex by reason of the existence of five power stations and four separate distribution districts and systems. A summary of the conclusions and recommendations of the report is as follows:—

The net loss of £3,769 for the financial year ending March 31st last arose partly from the awards of the Committee on Production and of Sir George Askwith ante-dated to September 1st and October 1st, 1917, respectively, and partly from the insufficient increase added to charges made to consumers. Several months' notice had to be given of any intended increase in charges, and thus no special addition could have been made in 1917-18 to cover the wages awards. The increased charges, which from August 1st last amounted to 75 per cent. on pre-war rates, should guard against any deficit during the current year. The public must realise that coal had risen from a pre-war average of 11s. 5d. per ton to an average to-day of 24s. 8d., an increase of 116 per cent. (the actual price at the central station being over 29s. per ton), that wages had risen over 20 per cent. during the last year, and that interest on capital was seriously higher. Therefore charges to consumers should be reasonably increased to cover these costs. Instead of the uniform 75 per cent. which the Corporation had added to all consumers' accounts, lighting consumers should have been charged with 87 per cent. increase, and power consumers 72 per cent. These additions should give the same result as the uniform 75 per cent. all round. As a matter of policy, however, the latter increase should remain unaltered, at any rate, for the current year.

There were certain pre-Federation contracts in the Burslem area on which the Corporation was losing heavily. They

ought never to have been entered into at the low prices contracted for, as it would not have been possible for the small Burslem station to have ever supplied power at ½d. The charges to consumers differed in each of the four districts to an absurd and entirely unnecessary degree, and the time had now come when the scales of charges should be made uniform. The present time afforded an excellent opportunity to prepare for such a change, and a scale of charges could be judiciously fitted to meet all cases.

There were five systems now being worked within the Borough, viz.: 3-phase, 50 cycles; 1-phase, 100 cycles; and D.C. 480, 460, and 440 volts respectively. The efficiency of distribution was 70 per cent. The sooner those distribution systems were unified the better. In the first place, certain of the single-phase sub-stations should be changed over to the 50-cycle system, and supplied from the central power-house without a double transformation. That improvement could only be carried out gradually, but when completed would save over 3,000 tons of coal per annum by shutting down the steam plant in the original Hanley station. The whole of the D.C. consumers ought gradually to be changed to the pressure of 480 volts, and the other two pressures eliminated; the necessity for that improvement was, however, not pressing. Though the several stations were not strictly comparable, the coal consumption per unit at Burslem, Hanley, Longton, and Stoke was much higher than at the central station. Had it been possible to generate all the energy at the latter station in 1917-18, instead of at five different places, there would have been a saving of at least 5,700 tons, or £5,195—although the coal cost per ton delivered was lower at the local stations than at the central station. Could that end have been attained, the total saving would have amounted to £11,400 per annum; there could be little doubt as to the correctness of that figure.

The site of the central power station was not a fortunate one for a large station; the canal water apparently could only be used through the agency of cooling towers, and the amount of make-up water was strictly limited. The station was on the top of a hill, with the boilers at the highest part of the site. All coal had to be carted at considerable cost, which, however, might be somewhat reduced by the use of electric vehicles. The design of the station did not lend itself conveniently to extension for large units, and facilities for coal storage were quite inadequate. The Corporation was not justified in incurring any expenditure other than was absolutely necessary upon a station which would certainly be outgrown in a few years' time. It was, nevertheless, essential to concentrate the generating plant; just sufficient plant should be added to the central station at the lowest possible cost. Steps should be taken at the same time to secure an adequate site elsewhere, with the best water and coaling facilities, so that after the war a station might be erected containing large units and all modern appliances. Inquiries ought to be made as to the availability of waste heat from the blast furnaces or local coke ovens, as those sources of energy ought to be utilised to the advantage of the suppliers and the public.

The total load in 1917-18 was 4,419 KW., and it was estimated there would be a new maximum load of 6,250 KW. in 1922-23. With the completion of the present 3,000-KW. extension and the addition of another 3,000 KW. the station would be able to meet the demand for another two or three years. The present boiler capacity was insufficient, and three new boilers of 25,000 lb. each should be added. No more than was absolutely necessary should be spent on extensions to buildings; it was lamentable to think that there was the old Hanley station next door, of which some use could not be made. Two new cooling towers, each of 200,000 gallons, were required. Owing to the present cost of wood, the possibility of using canal water direct or a cooling pond with sprinklers should be considered. The necessary changes at the local stations would involve a third 600-KW. converter and switchgear at each station. Some further development of the general H.T. cable system would also be required for some time to come. A proper protective system ought to be included for the H.T. cables; partial provision had already been made for that, but the then director of electric power supply postponed the proposal to complete the scheme.

The total cost of the extension and improvements (possibly reduced to £89,000) would be £102,000, the capital charges on which would be covered by the saving previously referred to, and there would be a net surplus to carry forward.

Stoke was 30 miles from any other large electrical undertaking, and it was not likely, therefore, to be included within any new and larger electrical district which might be set up. With the expansion of the future, the Corporation would be asked to undertake the supply of electricity within a radius of 10 or 15 miles from the borough. The H.T. system was of the right kind, collieries were actually within the district, and the sole difficulty was the want of ample condensing water. It would be advisable for the Corporation to be prepared with a well-considered scheme for submission to the Electricity Commissioners when that body was set up, and there was no time to be lost.

The tramways were considered as a probable consumer. The Corporation had the right to purchase the greater part of the system in 1924, and the other parts in 1932. It would be in the public interest if the Corporation would now negotiate with the company (*a*) to settle by consent the date for the purchase of the whole system; (*b*) to shut down the company's two small generating stations, and to purchase energy from the Corporation.

After considering the report, the Council decided to proceed with the expenditure of £102,000 for extending the central power station, and postponed the question of a new station on another site.

THE TRADE OF NEW ZEALAND.

The following extracts of interest to the electrical and allied trades have been taken from the recently-issued report of H.M. Trade Commissioner in New Zealand (Mr. R. W. Dalton). The full report may be obtained from the Stationery Office, price 3d. (Cd. 9175.)

Machinery Imports.—This is the first year in which the imports of machinery from the United States have exceeded those from the United Kingdom. Since 1914 the share of the United States in the total trade in this class advanced from 24.6 per cent. to 41.2 per cent., while in the same time the share of the United Kingdom has declined from 59.0 per cent. to 39.9 per cent. If one could regard the future in this trade with satisfaction the position would not be as disquieting as it seems, but, as a matter of fact, it will probably be in this line that British manufacturers will be hardest put to it to recover lost ground. Since I came to New Zealand I have referred repeatedly to the question of our position in the engineering and machinery trades, both in published reports and in confidential reports to the Board of Trade. It is, perhaps, unnecessary to cover the same ground again, but I would urge that previous suggestions made by me should be given the most careful attention. As I have frequently pointed out, our position is particularly weak in certain machinery, and in some we do practically no business at all even in normal times. In some cases the reason is that our firms have not attempted to make certain machines on a competitive basis, but in others it seems only too true that our agency systems and pioneering work are not as thoughtfully planned, or as energetically carried out, as they should be. After the war there will be a considerable opportunity here for the sale of machinery and plant, in connection both with the development of industries, whether primary or secondary, and with the execution of public works which are admitted to be urgently necessary. It is not safe to imagine that because this is a British Dominion our trade here must necessarily be safe. American firms have not only secured some of their most valuable trade since the war in British Dominions, but, apparently, they have also designed and organised to do so. I hope that firms and associations at home will realise this, and will take steps to see that, as soon as the war is over, if not before, expert investigations are made and plans laid to go more energetically into this branch of trade in New Zealand.

The imports of *electrical machinery* from the United States increased from £60,701 in 1914 to £113,615 in 1917, while those from the United Kingdom decreased from £392,168 to £305,249. I have reported at length to the Department of Overseas Trade on the subject of the development of the electrical trade in New Zealand and the competition of the United States. The question is also referred to in my last annual report. Japan has increased her trade in *insulated cable and wire* from £8,853 in 1916 (the first year in which Japan supplied this market) to £10,052 in 1917. I am told that the wire supplied from Japan is not at all satisfactory.

Hydro-Electric Developments.—The development of roads and railways will call for urgent attention, but it seems likely that the chief part of the public works programme of the Government will be the utilisation of water powers for the production of electric energy. This matter was referred to at some length in my last annual report, and it is one to which firms at home should give the closest attention. The hydro-electric works at Lake Coleridge have been so successful that not only is the Government convinced by its success of the practicability of developing other schemes, but the general public is prepared to press the authorities (and is already pressing them) to proceed with the large programme which has been drawn up. The programme provides for a series of schemes designed to supply the whole of the North Island with hydro-electric power from three sources eventually to be linked together. The Chief Electrical Engineer to the Government, in a report on the possible development of hydro-electric schemes in the North Island, suggested the utilisation of waters of the Mangahao River, the Waikato River, and Lake Waikaremoana, the first to supply the south-east and south-west, the second the centre and north-west, and the third the north-east of the North Island. It was suggested that the first two should be proceeded with at the earliest possible moment, and that the third should be deferred until railway communication in the Hawkes Bay and Poverty Bay districts had been improved. Considerable pressure is being put on the Government to proceed with all these schemes at once. Whether the Government decides to proceed with all three schemes together or not, it seems certain that the first two will be undertaken as soon as possible. It would seem, moreover, that New Zealand is cer-

tain to witness an era of hydro-electric development on a large scale. I cannot too strongly urge upon firms at home the desirability of watching this development closely, in order that they may get a reasonable share of the work which will be offering. It is believed here fairly widely that foreign firms have practically a monopoly of experience in high-tension water-power schemes. Foreign firms, too, are well represented, and have been able to consolidate their position in the market during the war. Consequently, if British firms are to obtain a reasonable share of the business which will undoubtedly offer, it will be necessary to show considerable activity.

So far as the Lake Coleridge scheme is concerned, it may safely be said that the development of the use of energy in the district covered is only limited by the inadequacy of the available supply. The Christchurch district is convinced of the value of electricity for all purposes, and the Government has found it necessary to limit new installations until the water-power works can be extended. It is anticipated that the scheme will give rise to considerable development of industries which are helped, or are made possible, by the availability of electric power. It is also proposed to utilise electric energy extensively for agricultural and dairying purposes, and a beginning in this direction has already been made. The Christchurch City Council is most enthusiastic in its advocacy of the use of electric power, and is giving every facility (subject to the limitation of supply) for new installations and for the development of new uses; it is also giving special service to encourage the use of electric vehicles for transportation and delivery purposes. The Government engineers (Mr. Evan Parry and Mr. Laurence Birks) are giving every possible assistance throughout the district to new industries depending on electricity, and are closely watching and encouraging distributing enterprises which have been initiated or are proposed. The total installed capacity of the Lake Coleridge works is now 8,000 H.P., but an additional unit is on order having a capacity of 4,000 H.P.

The following extract from the Public Works Statement presented to Parliament in the middle of 1917 will give an indication of the development of the Lake Coleridge scheme :—

> The financial results of the year's operations may be considered satisfactory, and a balance of £7,865 was carried to the net revenue account. The prospects for the present year are promising, and there is every indication at present that the undertaking will earn sufficient to meet interest charges and depreciation as well as working expenses.
>
> During the year the feeder lines have been extended from Belfast to Kaiapoi, but owing to the lack of material and other considerations extensions in other directions have had to be postponed. Urgent requests have been received from Akaroa, Southbridge, Leeston, Timaru, and other municipalities and districts on the route of the transmission line from Christchurch to Timaru, but it has been impossible to comply with these requests. The demand for power threatens to exceed the capacity of the present machinery, and, having regard to the difficulty of obtaining delivery of machinery and plant on order to cope with the demand, the Department has declined for the present to enter into fresh contracts of any magnitude. A request has also been addressed to the Christchurch City Council and other local authorities taking a supply from the Department to exercise restraint in making new contracts.
>
> In order to tide over the difficulty of shortage of plant, and to enable the Department to place the whole of the machinery in Lake Coleridge in service, a contract is being negotiated with the Christchurch Tramway Board and with the Christchurch City Council for the use of their steam plant for stand-by purposes.

Apart from the schemes definitely proposed, other districts in New Zealand are pressing for works to meet their needs. Amongst these the Southland district, largely through the activities of the Southland League, hopes to proceed with its own scheme to meet urgent needs pending the inauguration of a Government scheme. Powers are being sought for this purpose, and if these powers are given a steam plant will be installed to serve the greater part of the southern district of the South Island.

THE DYNAMICAL THEORY OF ELECTRIC ENGINES.

The tenth Kelvin Lecture was delivered before the Institution of Electrical Engineers on November 7th by Mr. Llewelyn B. Atkinson, M.I.E.E., who said that the prodigious growth of electrical science and its applications made it difficult for the younger generation of electrical engineers to realise what Kelvin was or what he did for electrical science between the years 1845 and 1895; in his own experience there were many of the present generation of electrical engineers who were quite ignorant of some of the scientific truths which Lord Kelvin presented to the world. He therefore purposed to concentrate attention upon one of such truths, and its results, which he thought was and had been overlooked and ignored.

In 1853 Lord Kelvin, then Professor William Thomson, read a paper before the Glasgow Philosophical Society on the "Mechanical Values of Distributions of Electricity, Magnetism, and Galvanism," in which he, for the first time, enunciated the principle that every distribution of electricity, magnetism, or electric currents had a definite energy value which was calculable, and he gave expressions for some of these values. This paper of Kelvin's was the first definite statement giving the method of calculating the energy related to electrical and magnetic conditions.

The original paper was divided into three heads. The first dealt with electrostatically charged bodies. He said :—

"The mechanical value of any electrification of a conductor has a perfectly definite character or may be calculated by means of formulæ demonstrated in this communication. The simplest case is that of a single conductor insulated at a distance from other conductors, or with only uninsulated conducting matter in its neighbourhood. In this case the mechanical value of the electrification of the conductor is equal to half the square of the quantity of electricity multiplied by the capacity of the conductor."

Later on he gave the general case of a system of electrified conductors and showed that the general expression for the energy W was

$$W = \Sigma (Q\ V),$$

where Q was the quantity of electricity on each conductor and V the potential of the charge.

The paper then passed on to the case of the mechanical value of magnetism. By a very subtle process of reasoning Kelvin arrived at the result that if W was the total energy in a given volume of magnetic material, R the magnetic force, and k the permeability, every element of volume contained energy proportionate to the square of the magnetic force and to the permeability, and the total energy W was

$$W = \frac{1}{8\pi} \int\int\int dx\, dy\, dz\, (k)\ R^2.$$

The part of the paper dealing with the energy of electric currents was ultimately expanded in Nichol's Cyclopædia, from which the following is taken :—

"Hence it is concluded that the mechanical value of a current of given strength in a linear conductor of any form is determined by calculating the amount of work against electro-dynamic forces required to double it upon itself, while a current of constant strength is sustained in it. The mathematical problem thus presented leads to an expression for the required mechanical value consisting of two factors, of which one is determined according to the form and dimensions of the line of the conductor in any case, irrespectively of its section, and the other is the square of the strength of the current. The mechanical value of a current in a closed circuit, determined on these principles, may be calculated by means of the following simple formula, not hitherto published,

$$\frac{1}{8\pi} \int\int\int R^2\, dx\, dy\, dz,$$

where R denotes the resultant electro-magnetic force at any point $(x\ y\ z)$.

"This expression is very useful in the dynamical theory of magnetic electric machines and electromagnetic engines."

Referring to the last paragraph, Mr. Atkinson said it was curious that neither Lord Kelvin nor any other writer had, in fact, developed the theory of generators and motors on the basis he then proposed, and it was the purpose of this lecture to show how a general theory and classification of electric engines arose from the principles Kelvin enunciated. The history of science and engineering showed many instances of the advantages arising from viewing a subject from a new standpoint. There was, in fact, a tendency at all times for the standpoint to crystallise, and accordingly for progress more or less to stop; a new standpoint might form a starting-point for new results, and it might be that to look on some problem with the eye of one of the founders of electric and magnetic science might form such a new starting-point.

The paper cannot be abstracted with advantage. In his "conclusion" the author said :—

"We may briefly review what ground has been covered. It has been shown that starting from the Kelvin original discovery and statement of the energy relations of the electrical and electro-magnetic quantities of any electric system, we may classify electric engines by the changes taking place in the energy put into such systems or taken out, electrically or mechanically. We have seen that we can then arrive at the ideal or possible efficiency of electric engines of various types. . . . The general types and cycles of electric engines have been classified and considered and their efficiencies set forth. And thus those words of Kelvin quoted at the beginning where he says the expression for the energy of an electromagnetic system may be very useful in the theory of electric engines have been justified. But the author hopes that this lecture may have some further use. The author has spoken of the advantage of a new view point, in stimulating thought and invention. It took something like 2,000 years to come from the original steam jet engine of Hero to the Parsons turbine. It may be that some of the early and simple types of electromotor may be revived in a much shorter time if the principles and reasons of their inefficiency are grasped. There is every reason why rotating machinery should be driven through belts or gears from rotating electric motors, there is no good reason why the brake air pumps on an electric train should not be driven by direct reciprocating motors.* We have considered that next to defeating the German armies the production in our own country of a magneto for petrol engine ignition has been the most remarkable achievement of the war. The possibility is that one tithe

* To realise some of the cycles described requires the solution of some questions, notably the putting of a coil out of circuit at the moment the current is zero. Some form of electrical non-return valve of higher efficiency than the aluminium valve has to be contrived.

of the energy devoted to this reproduction might have developed, an influence electrostatic generator for the purpose, of much simpler and cheaper construction. In any case, the use of electrostatic generators for some purposes would rapidly follow were they constructed of reasonable efficiency and moderate compactness. The younger members of this institution may well look into some of these questions, there are wide fields for new designs and experiments, and it is possible that the thought of the energy aspect which Kelvin put before us will prove to be fruitful of new departures. It is because the author thinks this aspect has been overlooked that he has ventured to go over ground that may have been already traversed by some of his hearers, but which was never apart from the thoughts and ideas of the great discoverer of whom we remind ourselves to-night."

THE FUTURE OF ELECTRIC RAILWAY OPERATION.

The following are a few remarks dealing with the future of electric railway operation, which we abstract from Sir John A. F. Aspinall's presidential address to the Institution of Civil Engineers on Tuesday, November 5th:—

So much was going to be done in the future by electrical operation that Sir John was led to mention that it had been his lot to take a somewhat active part in certain phases of the Government Electric Power Supply Inquiry and to come into contact with many of those who were interested in the supply of cheap electricity for industrial use, and that had led to the conclusion that there was a very strong desire on the part of all who were likely to be large consumers to see that the views expressed by the Electric Power Supply Committee as to the creation of suitable power stations in well-selected districts were carried out, though there were various objectors to the details of the methods proposed. The leading idea was, however, one of co-operation in any well-devised scheme, and a recognition of the prospective advantages of at last having some central authority, possessing both knowledge and power, to deal with that great electrical question of power supply.

One of the most serious questions which any new body of electricity commissioners would have to decide was whether it was better to put the generating station in the midst of the coalfields or in the midst of the industries which it was desired to supply with power. Was it cheaper to convey the coal for generation by a long line of railway, or to convey electricity by a long line of copper?

Those would be nice questions involving the balancing of all-round costs, and would vary much in different districts.

The demand for electrical energy by the railways would be far in excess of that for any other industry, and it was open to doubt whether it was wise to divorce the control of generating stations for railway supplies from the management of those who were responsible for the operation of the traffic, and the same question arose when some of the great municipal supplies for tramway working as distinguished from lighting were considered. The movement of traffic of all kinds required the instant command of power, and knowledge of the requirements was not likely to be appreciated by those who had never come in contact with traffic problems. The super-power station was a modern necessity, and the question of that control required much discussion and thought.

There had been at least three Government departments which had considered that they had interests in connection with electrical matters, and their diversity of view had most frequently led to delay, and their decisions had often been guided by conservatism, and, sometimes, want of knowledge.

Electrical progress was so rapid that it could not prosper without a due recognition of the necessity for accepting changes of method, and the vigorous youth of the industry connected with it was such as to require the continuous assistance of broad-minded men whose one desire should be to assist in advancement.

It was not only in the manufacturing districts that electricity would be required, as we could now see that its use was extending to agriculture. That being so, it might be that the distribution of energy in agricultural areas would not only assist the farmer in working the light railways which he mentioned elsewhere in his address, but the very fact of electricity being thus used would facilitate its distribution along roads in the country where, if he would, the farmer could make use of it for the stimulation of his cornfields.

Had it not been for the war, he believed a very great extension of the use of electric power would have taken place in railway working, whereas no great additions to electrical plant—where they had not been initiated before the commencement of hostilities—had been possible during the last four years.

The three chief additions to our electrical mileage which had been opened recently were those of the London & South-Western Railway for suburban traffic, the London & North-Western lines to Watford, and the Lancashire & Yorkshire Railway between Manchester, Bury, and Holcombe Brook. The voltage at the third rail was 600 for the two former, and 1,200 for the latter.

So far there did not appear to be any reason for supposing that when we could begin again to do work of that kind it would be rapidly extended for long lengths of main line of railway, but electrical working would remain for the present as a great stimulator of suburban traffic.

It was really remarkable how, when each suburban line had been worked by electrical trains with great frequency and increased rapidity, there had been a very great growth of passenger traffic, and he could not help thinking that the probable course of events would be that we should find the electrification of the lines immediately round our great towns would quickly take place all over the country, and probably be added to in widening circles as time went on; but it was not until those widening circles began to touch one another, and thus enabled longer-distance trains to run between one great centre and another, that we should see electrical working used for long-distance passenger trains.

The additional revenue required to pay interest on the large capital outlay could be made most rapidly from the suburban traffic in well-selected districts and then the extension of main-line work could be carried out without outlay which, taken by itself, might be unremunerative.

For shunting and operating in and about large towns where there were already electric railways for suburban traffic, there seemed to be an immediate future, and we should possibly see the application of such methods to heavy goods trains at a later date.

When expressing the hope of seeing great progress in the future for electric traction, he again, as he had done on several previous occasions, ventured to suggest that there was much to be gained by regenerative control on electric railways. The difficulties of obtaining it in all forms of electric traction were known, but let us hope they might be swept away. It seemed a barbarous thing to continue to convert power at every stop into heat by the abrasion of the tire and the brake block instead of turning the stored-up energy of the train into useful work by the generation of electricity.

The very successful operations in America which were detailed by Mr. Hobart in his "James Forrest" Lecture* were an indication of what could be done in hauling heavy trains by electric locomotives. It might be necessary to mention one or two cases where our American friends had produced extremely powerful electric locomotives to show the way in which they were seeking for more efficient haulage.† For instance, a very powerful electric passenger locomotive for the Chicago, Milwaukee & St. Paul Railway had been produced of 3,200 h.p., with a tractive effort of 112,000 lb., measuring 90 ft. overall, weighing 266 tons, and having an adhesive weight of 330,000 lb.

For freight services the Pennsylvania Railroad had built an electric locomotive weighing 240 tons, of which 198 tons was on the twelve driving wheels. It had a starting tractive effort of 130,000 lb., and was fitted with regenerative control.

In that case two locomotives were used, one at the head and the other at the tail of the train.

When operating with two locomotives it was intended to haul loads of 6,300 tons on a ruling grade of 1.33 per cent.

We should look forward to hauling much larger and heavier goods and mineral trains, once our structure gauges were altered and our bridges were strengthened, and it might not be looking too far ahead to suggest that the use of wireless telephony was one of the things which was going to help the operation of long goods or coal trains in the future.

The very successful use of wireless telephony by our Air Force—which was using an efficient and compact apparatus—pointed to the possibility of a locomotive so fitted at the head of a train being put in easy communication with another locomotive at the end of the train, the drivers of both being thus able to work together, stopping or starting or applying the brakes on the instant of receiving a message which could also be communicated to the rear guard.

WAR ITEMS.

Steel Prices.—An order by the Ministry of Munitions is printed in full in the *London Gazette* for November 8th, modifying prices and provisions for dealings in certain classes of steel.

Non-Ferrous Metal Industry Act.—A further list of licences granted under this Act appears in the *London Gazette* for November 8th.

Dr. Walther Rathenau.—It is recorded in past pages of the Electrical Review that Walther Rathenau, of the A.E.G., while confessing that this war was started too soon, counselled Germany to see that that mistake was not made next time. What does Rathenau think now? Those who have cherished "next time" ideas may be safely left to the attentions of the German people, but the Allies also must not be unmindful of those who have entertained such devilish aspirations.

* Abstracted in the Electrical Review of January 28th, 1916.

† See Electrical Review, June 21st, July 12th and 19th, 1918.

Herr Ballin.—Reports from Hamburg state that Herr Albert Ballin, managing director of the Hamburg-America Line, has died suddenly, at the age of 62. One dispatch attributes his death to suicide.

The Huns' Work at Lille.—According to a French correspondent at Lille, who reports the German destruction of textile factories and engineering works, some steam engines, completely finished, packed, and ready for transport, have been reduced to scrap iron. The dynamos, transformers, conductors, and apparatus in all industrial works have been carried off, excepting certain dynamos which it was possible to hide underground.

Exemption Applications.—Before the Kesteven Appeal Court, on November 5th, P. A. Baxter (26), electric wireman, engaged at the Grantham Electricity Works, appealed, and the manager, Mr. J. E. Edmundson, said that if the man left it would place them in a "hole," as he was now running a shift on the switchboard. Exemption to January 31st was granted.

Oxford Tribunal has granted three months' exemption to J. R. Colston (46, Grade 2), electric light fitter and contractor.

Tribunals and Demobilisation.—Sir Evan Spicer proposed, at a meeting of the Camberwell Tribunal, that the Local Government Board be informed that the Tribunal felt that it would be a great advantage to the State if the work of demobilisation was centralised at the town halls throughout the country, and the machinery on which the very responsible work of maintaining an equilibrium between the Army and public requirements had fallen so heavily should be retained for the work of demobilisation.

The Tribunal suggested that copies of the trade cards which have been made for individual men serving in the Army should be sent to the local Tribunals where they were employed, and that the tribunals, having full knowledge of local requirements as to labour urgently required in the various branches of industry operating in their area, could so arrange matters that these men could be demobilised by the Army in the order that they recommend, and would thus be discharged direct from the Army into their civil employment.

This would apply not only to men who have joined up voluntarily, but also to men whose cases have been dealt with on an appeal, either by the employers or the men, previous to their Army service. The Tribunal considered that no department of the Government could be more cognisant of the facts concerning these men than they were, holding, as they did, the records of the employers and the men which were taken on hearing their cases.

The Tribunal adopted the resolution.

Enemy-Owned Patents.—In the House of Commons last week, Mr. Wardle, Parliamentary Secretary to the Board of Trade, answering Sir R. Cooper, said an order had been made by the Board of Trade vesting enemy-owned patents and the benefit of enemy patent applications in the Public Trustee, and under the Trading with the Enemy (Copyright) Act the copyright in any works first made or published in an enemy country during the war also vested in the Public Trustee, who would hold the enemy property vested in him until the termination of the war. The ultimate treatment of this property as well as of enemy-owned trade marks was a matter which was engaging the consideration of the Government.—*The Times.*

The German Economic System After the War.—An article in *Der Welthandel* (October 12th) discusses the prospects of the German economic system in the event of peace being concluded on the lines of President Wilson's proposals. "The panic on the Berlin Stock Exchange has induced a feeling of pessimism, but the sharp fall in prices was not, the article claims, occasioned by any fears as to Germany's economic future, but was largely due to a reaction consequent upon the exaggerated prices, which have obtained for so long. It would be idle to deny that the peace on President Wilson's terms will bring about momentous changes in the structure of Germany's economic system, but the production and labour of a nation like Germany cannot be dispensed with by other nations, especially at a time when a shortage of goods and manufactured articles will prevail everywhere. Coal and iron, the main props of every vigorous industry, are found in abundance in Germany, and the war has caused the importance of lignite and its by-products to win more general recognition. Germany's zinc resources enable her to employ this valuable metal as a substitute for copper and other metals, while other nations cannot dispense with the high scientific standing of German chemists and engineers. If the dreams of many industrialists as to a westward extension of Germany's iron deposits are doomed to disappointment, she has ample supplies of her own, and will also have at her disposal Russo-Caucasian ores, quite apart from those of Sweden and Spain. During the war Germany's industries have made a great advance technically, and will be capable of fulfilling the tasks imposed upon them after the war. It is possible that at first export will encounter great difficulties, since raw materials will be hard to obtain, but the industries will find strong support in the home market, whose demands will at first be so large that there will be no question of exports. It must not be forgotten that during the war the industries of Germany's main rivals, the United States and England, have also advanced and been extended. Before the war Germany was ahead of all her rivals in fine steel manufactures, and these will doubtless remain the basis of the German economic system after the war, since it will be precisely the finished manufactures which will be in greatest demand, and since these products command higher prices than half-finished articles, by giving every encouragement to this industry Germany's finances will regain their equilibrium and her exchange be improved. With regard to the competition of countries now hostile these will doubtless try to continue manufacturing articles formerly obtained from Germany, but owing to the stress of war produced at home. But the shortage of labour and technically-skilled operatives will prevent England and America from making themselves industrially independent of Germany."

The foregoing note was in print before the Armistice was signed, but the comments are nevertheless interesting.

The Position of Munition Workers.—Whatever many people may feel regarding the excessive wages that have been received by large numbers of munition workers, and the prodigality of some of them, there can be no question that it would be a penny wise and pound foolish policy to deal with them other than considerately, even generously, now that the change over from war conditions in the factories has to be made. The upheaval in the industries during the past four years has been so great that it is not to be supposed that we can get over all our difficulties either in a hurry or without expense. The change to peace productions has to spread over some time, and the outlay of millions more of money will be justified if it help to obviate some of the industrial unrest that it is not unreasonable to expect during its progress. We print in full below the official notice that was issued by the Ministry of Munitions on Sunday evening last to contractors, sub-contractors, and workpeople engaged on the production of munitions:—

The statement of Dr. Addison was made on Tuesday in the House of Commons, but it is too late to deal with it this week.

The great task before the country is the transformation of industry from war to peace. This necessarily involves the disturbance and dislocation of industries and workshops, and very large numbers of workpeople will have to change their employment, and in many cases their present abodes. This must be faced. In order, however, that the change may be made with the least possible hardship and the minimum of waste, exceptional arrangements are necessary.

The Government intend to recognise in these arrangements the good work which has been done by munition workers in helping to bring the war to a victorious conclusion.

The Minister of Reconstruction, on behalf of the Government, proposes on November 12th, to make a statement to Parliament on the general reconstruction policy of the Government, and will give full details of the Government's intentions about unemployment, donations to demobilised members of H.M. Forces and civil war workers.

In order, however, that munition workers and their employers may at once be made aware of Government policy, the following instructions are hereby issued to all factories and firms engaged on work for the Ministry of Munitions:—

There should, so far as possible, be no immediate general discharge of munitions workers.

All workers, however, who desire to withdraw from industry or to leave for any reason, and all workers who can be absorbed elsewhere, should be at once released.

Production on contracts for guns and gun ammunition, machine-guns, small arms, and small arms ammunition; trench warfare mortars, bombs and stores, pyrotechnic stores, aerial bombs; all accessories of the above stores; aircraft and aero-engines; and the manufacture of explosives, should be reduced in the following ways:—

All overtime should be immediately abolished;

Systems of payment by results should be temporarily suspended and the customary notice of the transfer from payment by results to time work should be given.

When a transfer to time work has taken place a reduction of the hourly week should, wherever possible, be introduced. The reduction of hours will also apply to men already on time work, and in their case the customary procedure as to reduction of hours should be followed.

Whenever reduced hours are worked on a time work basis, the number of hours worked must not be less than one-half of the hours in the present normal working week of the establishment. If in any case the earnings of the workpeople for the full weekly number of hours on the short time system fall below the following amounts for:—

Men of 18 years and over 30s. per week;

Boys under 18 years 15s. per week;

Women of 18 years and over 25s. per week;

Girls under 18 years 12s. 6d. per week;

their earnings will be made up to these sums by the employer, who will be reimbursed by the State. Where time is lost, the amounts payable will be sums proportionate to the number of hours actually worked.

The adoption of half-time may cause unavoidable discharges, but every effort should be made to minimise unemployment, utilising employés for a short period on labouring and clearing up work. In allotting this work preference should be given to workpeople who are ordinarily dependent upon industrial employment.

All persons discharged, or claiming release, can obtain free railway warrants for journeys from the place of employment to their homes or to places where they have found new employment. The warrants will be issued through the Employment Exchanges. In cases where large numbers are required, warrants can be obtained by the employers from the Employment Exchanges for issue at the works.

Directions will be given at an early date with regard to war munition volunteers, Army Reserve munition workers, and other special classes of workers.

The foregoing instructions are issued for the guidance of contractors until individual firms receive further and particular instructions from the Ministry of Munitions. The loyal and cordial co-operation of all employers is confidently invited.

To provide for the abnormal period that must immediately follow on the cessation of hostilities, the Government have adopted as a temporary measure the following general scheme of non-contributory unemployment donation, which has been laid before them by the Minister of Reconstruction in agreement with the Minister of Labour.

The broad conditions of the scheme are that this unemployment donation shall remain in force for a period of six months from a date to be announced

shortly by the Government, and that the benefit can be drawn for a maximum of 13 weeks during that period in cases where unemployment cannot be avoided. The other conditions and necessary safeguards will be explained by the Minister of Reconstruction in his statement to Parliament, and he will then also deal fully with the scheme that will be applicable to the demobilised members of H.M. Forces.

Under this temporary non-contributory scheme, which will remain in force pending the introduction of a general contributory scheme, demobilised civil war workers will receive benefits on the following scale:—

To unemployed men over the age of 18 years, 24s. a week.

To unemployed women over that age, 20s. a week.

There will be an additional allowance in respect of the first dependent child under 15 years of age, 6s. per week, and 3s. for each additional dependent child under that age.

There is a further provision for unemployed juveniles between the age of 15 and 18 of 12s. per week for boys and 10s. for girls, conditional on their attending a course of instruction approved by the Board of Education or other central department concerned.

It is necessary that industry should be rapidly transformed to peace conditions in order to provide permanent and reproductive employment for the civil workers and for the fighting men returning from the war. The proposals outlined above are solely intended to bridge over the inevitable period of dislocation.

It must be emphasised that the non-contributory scheme is a purely emergency measure. While it is in operation the existing compulsory unemployment insurance scheme will remain in suspense so far as benefits are concerned.

Contributions will, however, still be payable in order to build up a reserve of benefits for contributors when the temporary scheme comes to an end. Thus the special interests of contributors are fully safeguarded; in the meantime the Government are pressing forward with their scheme for general contributory insurance, which will be based on permanent considerations, and must not be prejudiced by the non-contributory scheme here announced.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

"Fraternity"—or Tyranny?

In answer to the question, propounded by your correspondent "Unity," "Would it not be better for the two societies to work in harmony, &c."? I am compelled to admit that it would! for the E.P.E.A., who are now in process of discovering the futility of demanding increases of pay, without the power to enforce such demands.

It is probable that our friends of the E.P.E.A. are realising the truth of this statement, and would like to combine with the E.T.U. to help them out of their present difficulty. If this is so, I would remind them that there can be "no representation without taxation."

Let "Unity" refer to the letter, in the same column of the current issue, under the heading "Work without Pay," in which, to the writer's personal knowledge, the recent demands of the E.P.E.A. are treated "with contempt," and characterised as "absolutely ridiculous" by the powers that be.

As to the tyranny side of the question, has anyone ever heard of an E.P.E.A. member refusing to receive any of the advances, bonuses, or other concessions obtained by the tyrannical methods *and* effective organisation of the E.T.U., nor do I anticipate any objection on their part to partake of any future benefits which may accrue, as the result of the efforts of this society.

Finally, if your correspondent is now satisfied that his society is entirely unable to ameliorate his present condition, then, in the name of common sense, let him join the society whose demands on behalf of its members are not, and never will be, treated as "absolutely ridiculous."

Scented Soap.

Smooth versus Undercut Commutators.

I was very interested in the short paragraph in your issue of the 8th inst. on the above subject, taken from the *Electrical World*, and I believe it would be useful to users and designers of D.C. machines if those who have had experience both of smooth and undercut commutators would express their views on this important subject. My own experience has been that, in general, it is advantageous to have the mica segments undercut to a depth of not more than 1/16 in. both in generators and motors, but I strongly deprecate the practice adopted by certain manufacturers of cutting down the mica segments ¼ in. to ½ in. below the level of the commutator surface.

Motors appear to work satisfactorily for the first year or two with deeply undercut micas, but in course of time the interspaces get choked with carbon and copper dust, and short-circuiting results, which overheats the commutator and frequently causes unsweating of the leading-in wires, and sometimes even burning out of the armature coils.

In some cases makers fill the deep undercuts with an insulating paste; although this is preferable to having nothing at all, it is by no means as satisfactory as mica, and if the motor happens to be over-oiled—a common fault when unskilled labour is employed—the chances are that the oil will soften the paste and cause a troublesome and sticky commutator.

Undercutting should not be adopted in the case of low-voltage generators used for electrolytic purposes where copper gauze brushes are provided, as this type of brush drags the copper across the undercuts and soon causes heating and loss of excitation.

Electric motors are being installed more and more widely every year by the small-power consumer—the butcher, baker, and candlestick maker—and this class of consumer expects his motor to work with practically no attention except regular oiling.

When squirrel-cage induction motors are universally adopted for small-power requirements, this ideal condition will become more nearly a reality, but at present with thousands of D.C. motors of between 5 H.P. and 10 H.P., working at 500 volts, the commutator is the part most liable to give trouble, and anything which will tend to make it work satisfactorily under adverse conditions is, in my opinion, worthy of the closest attention.

I trust that this letter will bring out the views of those who have experienced trouble with undercut or smooth commutators, and I feel sure, if the methods adopted for overcoming these troubles were stated, they would make interesting and valuable reading.

C. S. Buyers.

Glasgow, *November 9th*, 1918.

LEGAL.

Siemens Brothers' Litigation.

Mr. Justice Astbury was engaged on November 5th and 6th, in the Chancery Division, in hearing three actions in which Messrs. Siemens Bros. were concerned. The first two were brought by Mr. W. S. Morgan Burns and Mr. Chas. Eric Hambro against Siemens Bros. Dynamo Works, Ltd., and the other was brought by Messrs. Siemens Bros. & Co. against Mr. Burns and Mr. Hambro. The three actions were consolidated.

Mr. F. Russell, K.C., appearing for Messrs. Hambro and Burns, said that the actions mainly concerned the rights of the shareholders in the Dynamo Co. One of the two actions against the company related to the splitting of certain shares held by the plaintiffs in the Dynamo Co. Their holdings were large, and at present the shares were registered in three joint names, Mr. Burns's being the first. By the articles of association of the Dynamo Co. it was provided that only the person whose name was registered first should be entitled to vote, and one of the actions asked that the company should be ordered, as regarded a portion of the shares, to place them in the joint names in the reverse order.

His Lordship asked whether the action was not one taken by trustees.

Mr. Russell said that it was by trustees under a debenture trust deed. The second action, he said, raised the question whether the plaintiffs, Messrs. Burns and Hambro, validly demanded a poll at a certain meeting of the company. The third action, in which Messrs. Siemens Bros. & Co. were plaintiffs, raised a question, as mortgagors, as to the property constituting the security for the debentures. This consisted of certain shares in the Dynamo Co., and the question raised by Siemens Bros. & Co. was that although Messrs. Hambro and Burns were the registered owners of the shares in the Dynamo Co., they were not entitled to vote in respect of them except under the direction of Siemens Bros. & Co. The issued capital of the Dynamo Co. was 20,000 shares of £10 each, and, except for the seven signatory shares, they were all allotted to Messrs. Burns and Hambro, and their names were entered in the share register in respect of one block. The trouble, said counsel, arose in this way. There was a proposal to issue further debenture stocks by the Dynamo Co., and notices were issued convening a special meeting for that purpose. Suggestions were made at that meeting for the first time by those representing the Dynamo Co. that Mr. Burns was not entitled to vote in respect of his shares otherwise than at the dictation and request of Siemens Bros. & Co.; a doubt was thereupon raised as to whether the trustees were not being hampered and crippled in the exercise of their voting powers. The Dynamo Co., continued counsel, had a considerable number of enemy shareholders, and the Public Trustee, as custodian of these shares of the Board of Trade, was in negotiation with the company with a view to getting the company's articles altered so as to exclude in the future the enemy holdings, and the directors of the Dynamo Co. took the opportunity of altering the articles.

His Lordship, after hearing the arguments, gave judgment, in the course of which he said the plaintiffs in the first two cases were debenture stock trustees, and as part of their security they held 19,993 fully-paid £10 shares in the Dynamo Co. out of the total of 20,000. Under the articles of association it was provided that if more persons than one were jointly entitled to share, the person whose name stood first on the register, and no other, should be entitled to vote in respect thereof if a dispute arose between the Mortgagor Co., Siemens Bros. & Co., and the subsidiary company, Siemens Bros. Dynamo Works, Ltd., on the one hand, and the trustees on the other, as to the rights of the latter to vote in respect of the shares. A considerable portion of the dispute had already been settled by a decision in the Court of Appeal, on an

interlocutory motion. As matters stood, Mr. Burns alone was entitled to vote in respect of the shares, and if, in the event of his illness or absence from other causes, he was unable to vote, he could not appoint his co-trustee as proxy. In order to exercise the voting power which clearly existed in the trustees, they had requested the company to transfer a portion of the shares into the names of Hambro and Burns, in order that if at any time one of the trustees should be ill or absent, the voting power which belonged to them as trustees might be effectively exercised, and they claimed a declaration that they were entitled to require the Dynamo Co. to alter the register of members by inserting the name of Hambro as the person first named in respect of a portion of the shares. He had come to the conclusion that the trustees were entitled to have their names so entered in the register as to enable them to be in a position to exercise their admitted voting power in the event of one of them being unable to be present at any meeting. There must be a declaration in accordance with the claim, and a direction to the company to make the necessary change in the register. The defendant company would have to pay the costs.

Lighting Regulations.

In a lighting case, at Halifax, last Tuesday, the Chairman of the Bench (Mr. T. Hey) said the magistrates considered it was now desirable that some relaxation should be made in the carrying out of the Order, and therefore they were not disposed to impose fines as large as had been usual. In this case the defendant need only pay the nominal penalty of 1s. Whilst the Order continued, of course, cases would have to be brought to the Court, and they could not be dismissed.

Accumulator Company Fined.

According to the *Times*, the Fuller Accumulator Co., Ltd., Chadwell Heath, were fined £10 at Stratford Police Court, on Saturday, for failing to have a man employed by them on a lead process medically examined at least once a month.

THE INSTITUTION OF ELECTRICAL ENGINEERS.

North-East Centre.

The first meeting of the session of the North-East Centre was held at Newcastle-upon-Tyne, on November 4th. Mr. A. H. Marshall, the retiring chairman, in opening the meeting, referred to some of the more striking developments of the past session, and said the most noteworthy was the changed attitude of the Council towards provincial members. The Council had shown a strong tendency under their worthy president (Mr. Wordingham) to organise the Institution on a more democratic basis, and their new chairman, that night in addressing them, would do so, not as the chairman of the Newcastle Local Section but as chairman of the new North-East Centre of the Institution. That was significant of the new outlook. He mentioned as an example of the effect of that change, the fact that a paper, however originating, or of however high value it might be, could be read at Leeds, Manchester, or elsewhere as the case might be, if more convenient, before being read in London, and would be considered as having come before the Institution, just as much as if it had originally come before it in London. It had been decided also to devolve some of the research work upon the Local Committees, and generally to make them more efficient parts of the Institution. A very important matter was the setting-up of the Local-Sections Committee—an idea which had originated with their own hon. sec., Mr. J. R. Andrews. As to research work, he mentioned that they had been entrusted with research into armoured cables, upon the initiative of Mr. Clothier.

Mr. A. P. Pyne, M.I.E.E. (the new chairman), then delivered his address. He said that not the least startling change in industrial conditions during the four years of war had been the developments in connection with electricity, which, having regard to the apathetic or deterrent nature of legislation in the past, would probably have been unattainable in this country for many years, without the stimulating influence of the war. The progress that was being made was by no means confined to generation and distribution, but was even more marked in connection with the application or utilisation of electricity for numerous industrial purposes. Such applications might be divided into three main categories:—(1) The provision of driving power for large works extensions, and for enormous munition factories which, it was hoped, would ultimately be used for industrial purposes; (2) the creation of industries almost, or entirely, new to this country, and dependent on a bulk supply of cheap electricity for their exploitation on a large scale, as in the production of nitrogen from the air; with this group might also be mentioned the electric furnace and the electrostatic method of removing suspended matter from gases; (3) the driving by electricity of heavy machinery, plant, &c., previously associated with steam. Electricity might there be said to be encroaching on vested interests to a much greater extent than in the previous cases, and, consequently, development proceeded on different lines. Where steam had been used with success in the past, it would not always be easy to demonstrate that electricity could be used with still greater success. The most noteworthy examples of this class were the electric propulsion of ships and the electrical driving of large rolling mills. The former had not been attempted on any large scale in this country, but the application of the electric drive to rolling mills was proceeding rapidly, and the one or two motors of 8,000 to 12,000 H.P. installed within the last five years were already being overshadowed by machines of from 15,000 to 25,000 H.P. now under consideration, which, so far as he knew, were as large as, or larger than, any plant of a similar character existing in Germany, which country was, prior to the war, vastly ahead of us in the electrical equipment of rolling mills. Sufficient motors for large reversible rolling mills were usually operated on the Ilgner modification of the Ward-Leonard system; the whole of the plant being placed in properly constructed and ventilated buildings, was not subjected to the smoke and dirt inherent in a steel works, and, consequently, such standard practice could largely be followed in the general design and appearance of these machines, as was consistent with the heavy duty they were called upon to perform. The mill motor must necessarily be of the direct-current type, of slow speed, and capable of rapid reversals. It was usual to provide independent cooling by means of fans suppling filtered air. The voltage would be as high as was consistent with good commutation. The generator, or generators, of the Ilgner set would be designed for high speed, and of corresponding voltage and capacity to the mill motor. The driving motor of the Ilgner set might be designed for either alternating or direct current; if the latter was available in close proximity there was no objection to its use, and it would be slightly more efficient than alternating current. Usually, however, local conditions would necessitate the use of alternating current, which allowed greater latitude in the choice of voltage, though not so much in that of speed. Large non-reversing mills requiring, say, 2,000 H.P. and upwards, were generally direct driven, and smaller mills through gearing with a fly-wheel on the motor shaft. The cost of totally-enclosed machine-cut gearing was so high that a low-speed motor and fly-wheel coupled direct to the rolls became a cheaper and simpler proposition. In cases where the speed or duty of the mill rendered it difficult to obtain the necessary fly-wheel effect with a direct drive, a rope drive should have serious consideration. The driving of rolling-mill auxiliary machinery by electricity had been more readily adopted in this country than had the driving of the actual mill itself, and in these minor drives greater divergence of practice was noticeable. This raised the question of the relative merits of A.C. and D.C., and in this country there was a strong tendency to use, or, at least, to advocate the use of A.C. Generally speaking, alternating current was not as convenient as D.C. for furnace-chargers, cranes, and similar hoisting machinery; it was, however, good enough, and where available, should be used in preference to incurring the expense, losses, and upkeep of transforming apparatus. In order to appreciate the problem, it was desirable to review the operating conditions, and the steps that should be taken to meet these conditions. The chairman then proceeded to deal with electrical equipment for live rollers, skids, and screwing-down gears. He presented tables giving, in each case, the average of a series of observations taken under actual working conditions, which emphasised the severity of the duty:—

TABLE I.—Live Rollers.

Live rollers. No.	Size.	No. of reversals per min.	Time from full speed to full speed.	Max. input during acceleration.	Full-speed input.	Size of motor fitted (1-hr. rating).	Remarks.
	Dia. Length		Secs.	KW.	KW.	B.H.P.	
9	1′ 6″ × 9′ 0″	—	—	16·5	10·5	20	40-cwt. ingots
20	1′ 6″ × 7′ 6″	6	6	46·9	32·3	50	6″ × 6″ billets
14	1′ 6″ × 9′ 7″	9	7	52·4	39	50	12″ × 3½″ bulb angles

It would be seen that the principal features of this duty were the frequent reversals and the rapidity of acceleration. Live-roller trains varied considerably in number, size, and weight of rollers, and the motor fitted must be of corresponding H.P.; but the weight of the ingot, billet, or section did not appreciably affect the load on the motor.

TABLE II.—Skids.

No. of skids actuated.	No. of operations (out and back) per hour.	Time of each operation (out and back).	Total time motor is running.	Time of acceleration to full speed.	Max. input during acceleration.	Full speed input.	Kick when bar comes against the heap.	Size of motor fitted (1 hour rating).	Remarks.
—	—	Secs.	Min. per hour.	Sec.	KW.	KW.	KW.	B.H.P.	—
2	15	24	21	0·7	27·6	25·8	37·2	20	One 6 in. × 6 in. shell steel bar 14 ft. long.
2	12	28	21	0·9	23·5	19	26·2	20	ditto ditto.
2	—	50	31	0·6	35·6	27	—	20	Three bars. ditto ditto.

N.B.—Motor is capable of exerting five times normal torque.

This duty was somewhat different from that of live-roller gear; seeing that more time was available between operations, reversal was not so rapid, and, when returning the skid, the load on the motor was comparatively light. Heavy starting currents were, however, encountered, due to initial friction when skidding one or more bars from rest, and also to a possible attempt on the part of the operator to skid an excessive number of bars. Provision must

be made for ensuring that the motor or gear should not be damaged when a bar was skidded up against a heap of bars or other obstruction, thus bringing the skid suddenly to rest with current still on the motor.

TABLE III.—SCREWING-DOWN GEAR.

No. of operations per hour.	Time taken by each operation.	Total time motor is running.	Max. input during acceleration.	Full speed input.	Size of motor fitted.	Remarks.
	Secs.	Mins. per hour.	KW.	KW.	B.H.P.	
192	5·6	18	29	16·7	50	48-cwt. ingots to 6" × 6" shell billets.
216	6·2	22	26	16	60	ditto.
216	6·4	23	22	15	50	ditto.

The main feature of this particular duty was the short interval during which the motor was running, frequently amounting to "inching round" only. The usual practice was to screw down the top roll against the pressure of the balance gear. The load was, therefore, constant when screwing down, and was very light; when raising the roll the motor might sometimes be rapidly reversed should the operator overshoot the mark. It was also possible to screw the rolls hard together, but this was unlikely to happen with ordinary care.

The chairman emphasised the need for motors for such drives being placed in accessible positions; and, for the provision of suitable gearing, enclosed in dust-tight gear cases. The insulating material should be the best obtainable, consisting wherever possible of mica or micanite. The recognition of the necessity for a special type of motor for rolling-mill auxiliaries, and the extent to which these motors were coming into general use, made a considerable measure of standardisation highly desirable. The sizes of motors used in any particular works should be standardised, and the number of such sizes kept within small limits. This was facilitated by the fact that high efficiency was of secondary importance, and must give place to reliability and rapidity of replacement, which, therefore, permitted of the selection for a given duty of a motor of somewhat larger size than would be considered good practice in normal commercial work. Further, in some instances—such as long trains of rollers—it was advantageous to use two small motors in preference to a large one, and this might help to keep down the number of sizes.

The following table, taken from an actual rolling mill, would, with the possible addition of two or three motors, cover all the requirements of most mills of similar size. The columns headed 1 and 2, showed for purposes of comparison, the sizes proposed by two firms originally tendering for the installation; the next column showed the size of motor actually installed, and the final column the average normal and maximum H.P. actually developed:—

TABLE IV.—SCHEDULE OF MOTOR REQUIREMENTS FOR TYPICAL MILL.

—	B.H.P. of motor. Proposed.	B.H.P. of motor. Proposed.	B.H.P. of motor. As fitted.	Actually taken.
	B.H.P.	B.H.P.	B.H.P.	B.H.P.
Approach rollers No. 1 ...	68	190	50	56
ditto No. 2 ...	68		50	41·8
ditto No. 3 ...	68	160	50	49·6
ditto No. 4 ...	68		50	53
ditto No. 5 ...	68	160	50	47
ditto No. 6 ...	68		50	48·7
Long rollers No. 1 ...	33	30	50	50·8
ditto No. 2 ...	33	30	50	46
ditto No. 3 ...	52	50	50	49
Return rollers	52	50	50	51
Short rollers	20	20	20	20·4
Screw down gear	20	20	50	21·4
Skid No. 1 ...	20	20	20	19·5
ditto No. 2 ...	20	20	20	22·2
ditto No. 3 ...	20	20	20	21·3
ditto No. 4 ...	20	20	20	18·5
ditto No. 5 ...	20	20	20	20·3

It would be seen that two sizes of motor only were in use, and this without excessive first cost or undue effect on the efficiency. Where the use of these special motors was extended to cranes, and where mills of various sizes were to be found in the same works, then some extension of the number of sizes was desirable; but in all, except very exceptional, cases it would be feasible, by judicious arrangement, to ensure that four sizes should not be exceeded. The speaker referred at length to the relative merits of the A.C. and D.C. motors, and came to the conclusion that, taking the system as a whole, under the conditions enumerated, direct-current would be found considerably more efficient. Size for size, the A.C. motor would be considerably heavier and more expensive. Speaking of switchgear, he said that some form of automatic starting apparatus was necessary that would permit of acceleration at a predetermined rate, which must be as rapid as possible without damaging the motor, and which must take place independently of the operator, and magnetically-operated switches, known as contactors, had been developed, which satisfactorily met those conditions.

A short discussion as to A.C. and D.C. for mill driving followed, in which Messrs. Peterson, Arnold, Booth, and Roberts took part.

BUSINESS NOTES.

"Made in U.S.A."—The Executive Committee of the Merchants' Association of New York decided, on September 23rd, that the designation "Made in U.S.A.," in plain type form, should be used by all its members on all goods manufactured by them in the United States of America, and that the use of all other markings to identify the country of origin of such goods be discontinued. —*Board of Trade Journal.*

Trade In Poland.—A scheme is being promoted in Germany for the formation at Warsaw of a concern under the title of the Polish Electricity Co.-A.E.G., for the establishment of installations in Poland and the sale of machinery, plant, and apparatus, together with participation in the industrial undertakings in the "Kingdom of Poland." The founders are the A.E.G. and individuals bearing Polish names at Sopnowice, Warsaw, and Lodz, the share capital being £50,000.

Rumours Denied.—Mr. Thomas McLeod, chairman of the Power Plant Co., Ltd., West Drayton, Middlesex, writes to us as follows under date November 9th, 1918:—

It has come to our knowledge that reports to the effect that there are persons of enemy alien origin exercising influence in the management of this company are still being circulated. As these are detrimental to the interests of the company and likely to prejudice our business prospects, and are entirely contrary to the facts, we shall feel greatly obliged if you will kindly give us an opportunity of denying these rumours through your journal. The managing staff is made up as follows:—

R. J. McLeod	Managing Director.
Robt. C. Salt	Secretary.
W. E. Sykes	Assistant General Manager.
H. H. Thorne	Technical Manager.
R. E. Hughes	Works Manager.

The above gentlemen are all British born and of British parents. No capital whatsoever is now held either directly or indirectly by any person of enemy alien origin, and neither is there any person of alien origin holding any salaried position or receiving any benefit whatsoever from the activities of this company.

Liquidations.—MERTON METALLURGICAL CO., LTD.,—Winding-up voluntarily. Liquidator, Sir Woodburn Kirby, of Bassishaw House, E.C. Meeting of creditors, November 18th, at 2, Metal Exchange Buildings, E.C.

BLACKWALL ENGINEERING AND WELDING WORKS, LTD.—Petition for winding-up presented October 15th. Order made November 5th.

Catalogues and Lists.—CONSOLIDATED PNEUMATIC TOOL CO., LTD., 170, Piccadilly, London, W. 1.—Catalogue No. 9 E, of 46 pages, containing illustrated descriptive matter relating to their "Duntley" portable electric tools—drills, grinders, compressors, coal and ore borers, electric hammer and blower, &c. Views are given of the works at Fraserburgh, Scotland, showing electric tool assembling and a machine shop, also an armature-winding shop at Westminster.

MESSRS. DRAKE & GORHAM, LTD., 67, Long Acre, London, W.C. 2.—List No. 253, 28 pages, containing illustrations and brief tabulated particulars, including prices, of various types of electric lamps, reflector fittings, lanterns, pendant fittings, shades, electric fires of many designs, electric heaters, boiling rings, toasters, fuseboards, &c.

Trade Announcements.—We are informed that MR. W. HOLEHOUSE, managing director of the Davenport Engineering Co., Ltd., and patentee of the Bradford Patent Cooling Towers, has severed his connection with the company and is commencing in business at 21, Morley Street, Bradford, on his own account, to design and manufacture special cooling plant for large turbines.

MR. F. M. BURLEY, electrical engineer, having been discharged from the Army, has resumed business at 14, Hamlet Court Road, Southend-on-Sea.

THE ENTERPRISE MANUFACTURING CO., LTD., of Gun Street Electrical Works, Bishopsgate, London, E.C. 1, have been appointed agents for the whole of London, and the South Coast for Messrs. S. Hodgson & Co., of Halifax. Illustrated and descriptive price lists of Hodgson's D.C. motors and two and three-phase induction motors have been issued.

MESSRS. EVERSHED & VIGNOLES, LTD., give notice that they have closed their City Office at 110, Cannon Street, E.C. All letters should be addressed to the company's sole address, Acton Lane Works, Chiswick, W. 4.

Book Notices.—The "Punch Almanack," 1919 (1s. net), which has been issued from *Punch* office, is well worth securing both for mirth at home and for sending to our men "over there," who will want all the reading matter that we can send them during the next few months.

"Cutting Lubricants and Cooling Liquids."—A memorandum on this subject has been issued by the Department of Scientific and Industrial Research (Bulletin No. 2), in which is brought together a large amount of useful information likely to be useful to users of cutting lubricants, and to increase efficiency of production. The skin diseases produced by lubricants are also dealt with.

"*Transactions* of the Institute of Marine Engineers." Vol. XXX September, 1918. London: The Institute.

"*Transactions* of the Illuminating Engineering Society." Vol. XIII, No. 7. October 10th, 1918. The Society: Easton, Pa.

"*Journal* of the Engineers' Club of Philadelphia." Vol. XXXV—10, No. 167. October, 1918. Philadelphia: The Club.

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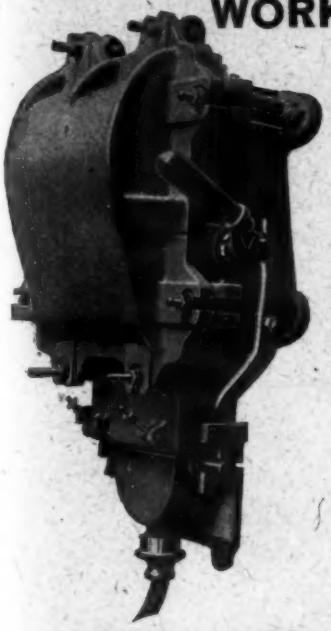

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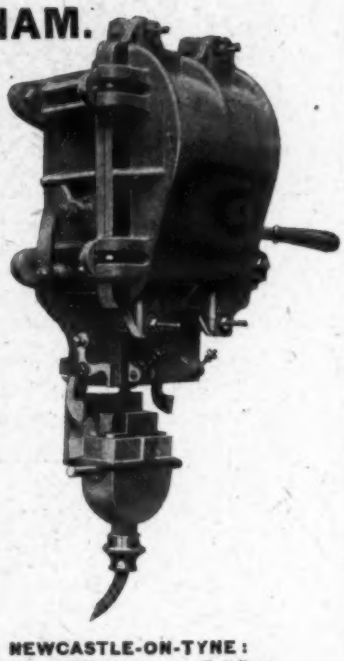

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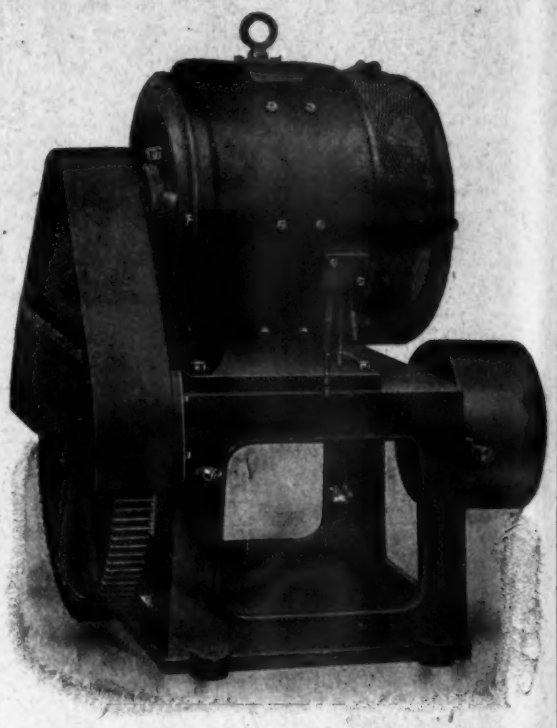

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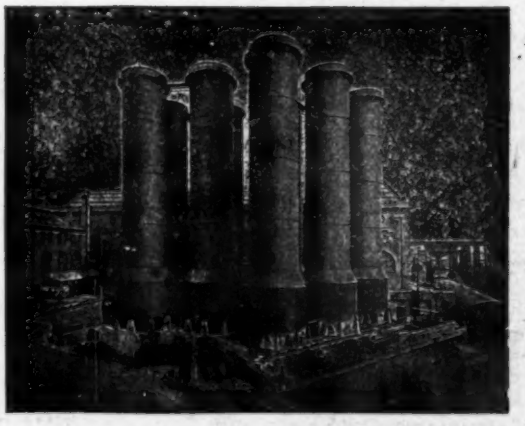

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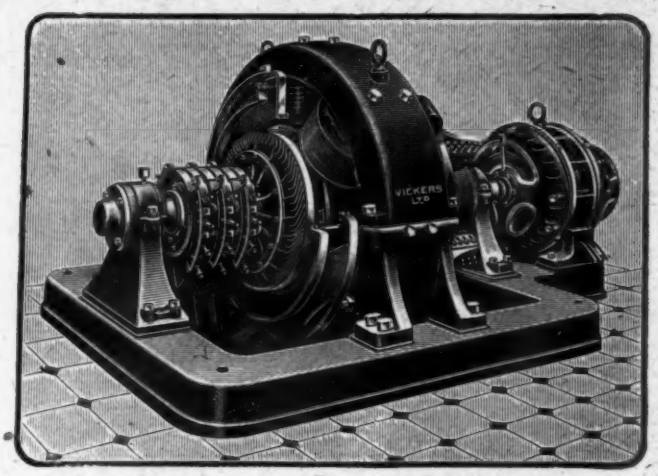

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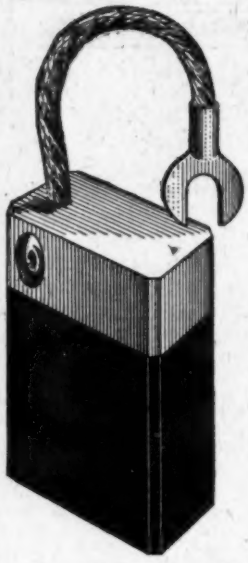

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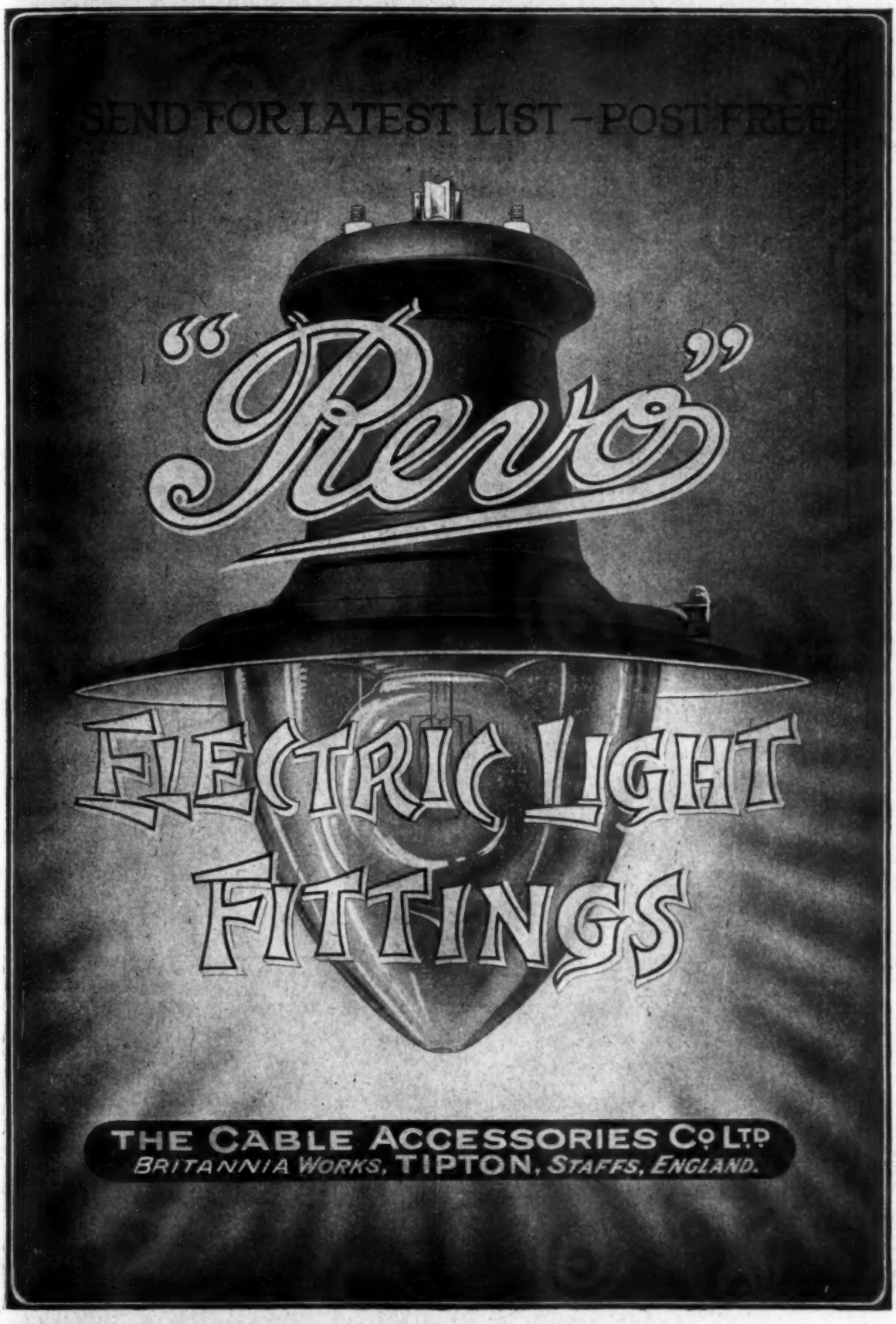

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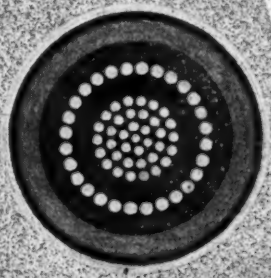

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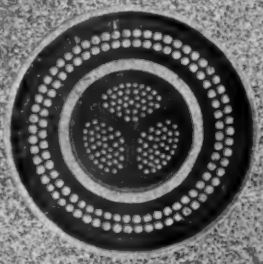

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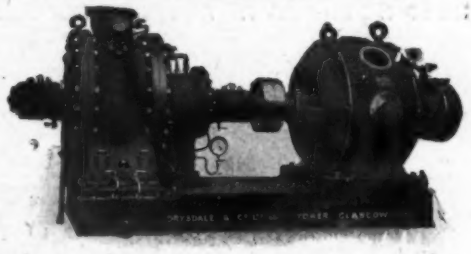

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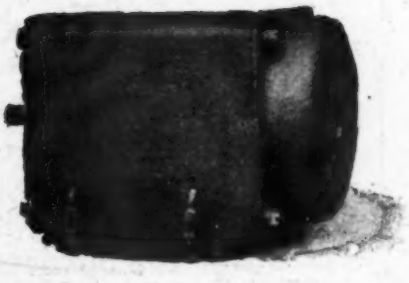

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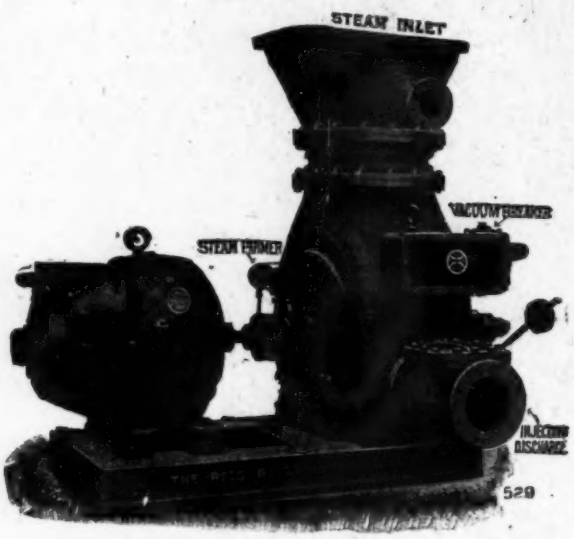

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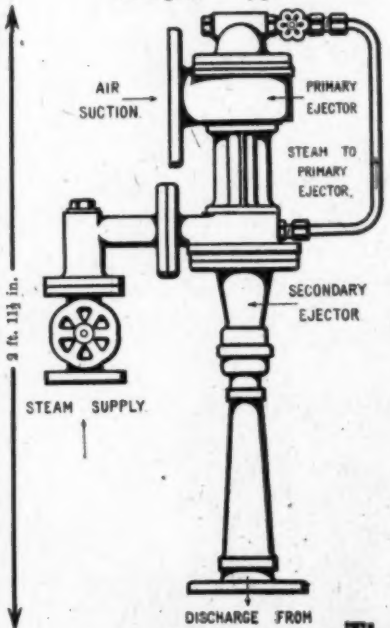

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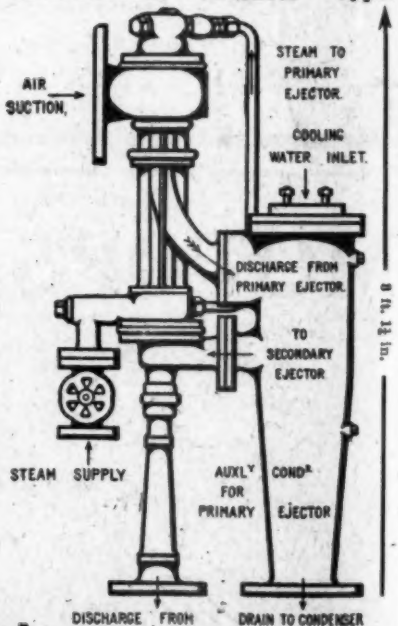

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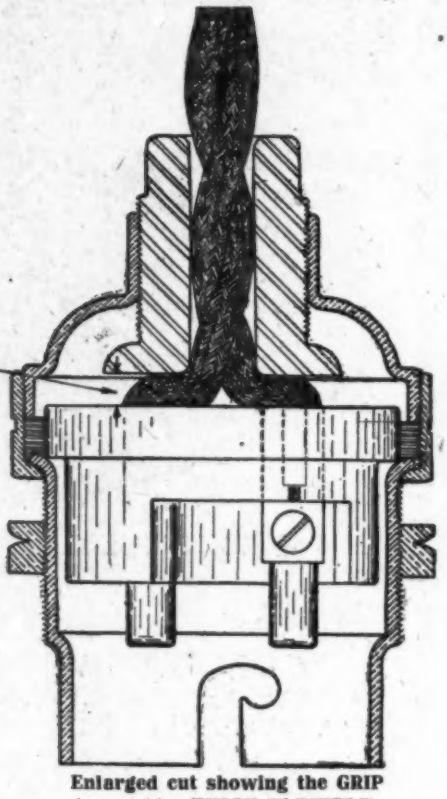
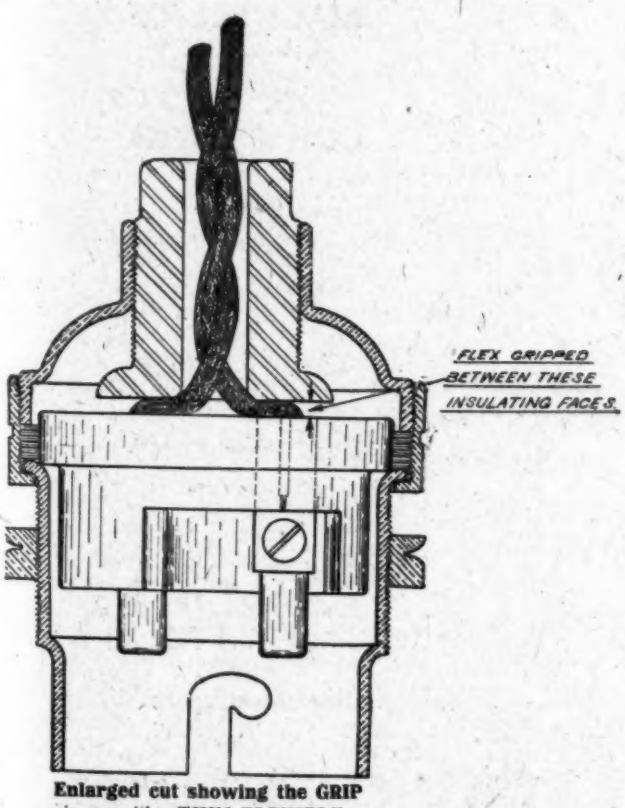


Enlarged cut showing the GRIP in use with a THICK FLEXIBLE.



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SITUATIONS VACANT.

Latest time for receiving 9.30 a.m. Thursday.

If letters are not to be delivered to certain firms or individuals (if known), instructions to that effect should be sent to the Manager of the ELECTRICAL REVIEW, who will do his best to carry out such instructions. Letters of applicants cannot in such cases be returned to them, nor can the names of Advertisers using a number in any way be disclosed.

Original Testimonials should never be sent.

ELECTRICAL CONTRACTORS.

WORKING MANAGER required for the Manchester House of a firm of Electrical Contractors. Commencing salary £200 per annum, and good commission on profits. Applications treated in confidence, and should state fullest particulars and whether applicant could introduce post-war business. No person on Government work, or residing more than 10 miles away, will be engaged.—5807, ELECTRICAL REVIEW, 4, Ludgate Hill, London, E.C. 4.

METER TESTER AND REPAIRER.

METER TESTER and Repairer wanted, used to A.C. and D.C. Meters. State age, experience and wages required. Must be used to keeping records and dealing with consumers' complaints.

Applications to ENGINEER AND MANAGER, Electricity Department, Guild Street, Burton-upon-Trent. 3196

JUNIOR SHIFT ENGINEER.

JUNIOR SHIFT ENGINEER, Yorkshire West Riding Power Station, three-phase and continuous current. Wages £3 4s. for 56-hour week.

Apply giving age, experience and references, to 3195, ELECTRICAL REVIEW, 4, Ludgate Hill, London, E.C. 4.

DRAUGHTSMEN.

DRAUGHTSMEN required for Government office at Portsmouth. Knowledge of electricity an advantage but not essential.

State age and experience to Box 792, Willings, 125, Strand, London, W.C. 2. 3111

SITUATIONS VACANT.—*Continued.*

JUNIOR ENGINEERS.

JUNIOR Engineers required for power station work for North-East Coast; preference will be given to men with some mechanical experience who have been discharged from Army and Navy. Good prospects for early promotion to Shift Engineer for suitable men. Wage, including awards, 62s., plus 12½%. 14 days' holiday per annum will be granted with full pay.—Applications in writing, giving full particulars of theoretical and practical training, to 3157, ELECTRICAL REVIEW, 4, Ludgate Hill, London, E.C. 4.

FITTER WANTED.

FITTER wanted for the maintenance of high-speed (B. & L.) engines, Lancashire boilers, feed pumps, &c. Experience in erection of high-speed engines essential. Wages 11d. per hour, plus 23s. 6d., plus 12½%. Certified undertaking.—Apply ENGINEER AND MANAGER, Electricity Works, Lomax Street, Radcliffe, Lancashire. 3171

CHARGE ENGINEER.

CHARGE ENGINEER for Municipal Power Station in Scotland. Must have experience with Turbines, Water-tube Boilers and High-tension Switchgear Operation.

Apply, stating age, experience and wages required, to 3173, ELECTRICAL REVIEW, 4, Ludgate Hill, London, E.C. 4.

SHIFT ENGINEER.

SHIFT ENGINEER required for three-wire system with batteries. A reasonable wage for a 56-hour week, plus bonus and 12½% on total earnings. One month's notice on either side to terminate the engagement.

Applications to ELECTRICAL ENGINEER, Bexhill. 3182

CABLE JOINTER.

CABLE JOINTER required, used to plumbing and working on live mains and high-tension jointing. Permanent position to suitable man; Lancashire district. Wages, including all bonuses, £3 15s. per week.—3188, ELECTRICAL REVIEW, 4, Ludgate Hill, London, E.C. 4.

METER TESTER AND INSPECTOR.

METER TESTER and Inspector for Municipal Power Station in Scotland. Must have experience with A.C. wattmeters.

Apply, stating age, experience and wages required, to 3174, ELECTRICAL REVIEW, 4, Ludgate Hill, London, E.C. 4.

WIREMAN WANTED.

WIREMAN wanted for general work on consumers' installations. Experience of installation and maintenance of motors essential. Wages 7½d. per hour, plus 23s. 6d., plus 12½%. Certified undertaking.—Apply ENGINEER AND MANAGER, Electricity Works, Lomax Street, Radcliffe, Lancashire. 3172

(Continued on next page.)

SITUATIONS VACANT.—*Continued.*

PLATELAYER.

WANTED, a Platelayer, with good experience of tramway repairs and reconstruction; rate 13½d. per hour, plus 12½% on earnings; permanency to steady reliable man.
Apply, stating age and experience, to GENERAL MANAGER, Corporation Tramways, Coventry. 3213

Cheap prepaid Advertisements are inserted under this heading at the rate of One Penny Per Word (minimum 1s.). Three Consecutive Insertions for the price of two, if ordered and prepaid with first insertion.
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A LARGE firm of Telephone Engineers and Manufacturers in the provinces (Government controlled), have vacancies in their Designs and Drawing Office Sections. Applicants must have practical and technical experience. No person already on Government work will be engaged.—Apply, stating age, experience and wages required, through your nearest EMPLOYMENT EXCHANGE, quoting A6404. 3193

ARMATURE Winder required at once with experience of D.C. and A.C. work; discharged man preferred. No person resident more than 10 miles away, or already on Government work, will be engaged.—E. P. ALLAM & Co., 107, Gray's Inn Road, W.C. 3202

ARMATURE Winder wanted; permanent job for good man. No person resident more than 10 miles away, or already on Government work, will be engaged.—Apply TOWNSEND, 10, Bush Lane, E.C. 3204

ARMATURE Winders, used to repair shop, D.C. work. No person resident more than 10 miles away, or already on Government work, will be engaged.—Apply H. D. & S., 32, Newington Causeway, S.E. 1686

ASSEMBLY Shop Foreman wanted by London electrical switchgear manufacturers. No person resident more than 10 miles away, or already on Government work, will be engaged.—Apply, stating age, experience and wages required, to 6050, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ASSISTANT Estimator for transformer work; must have some technical knowledge. No person already engaged on Government work need apply.—Apply, stating age, experience and salary required, to your nearest EMPLOYMENT EXCHANGE, stating No. A6310. 3097

CAPABLE Man wanted to take charge (with one young Assistant) of Electric Light Plant in small town. Annual output at present under 18,000 units. Plant consists of two 25-H.P. Tangye suction gas engines and dynamos and battery, overhead mains, 200-volt D.C. Wages £2 15s. per week and bonus on increased output. Good prospects and permanent, comfortable berth for competent man, preferably single.—Apply ENGINEER, Trinity House, Aldeburgh-on-Sea. 5999

CAPABLE Overhead Linesman required for the Dover Corporation Tramways; must have had experience of the erection of new trolley wires. Preference given to one with knowledge of armature repairs.—State age, experience and wages required, to GENERAL MANAGER, Corporation Tramways, Town Hall, Dover. 3064

CHIEF Electrical Assistant wanted for the engineering department of large industrial company in the South of England. Must have had good experience in both A.C. and D.C. factory work and generating plants, estimating, costs and repairs. Thoroughly experienced men only, with good technical training, should apply in writing, giving concise outline of training and experience, with copies of testimonials (no originals will be returned), also stating age and salary required, to 3192, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

DESIGNER (telephone instruments and kindred apparatus) required by Controlled Establishment in London area. Must be experienced man with good practical knowledge, and capable of evolving and developing new designs, particularly interphones. No person already engaged on Government work need apply.—Apply, stating age, experience and salary required, to your nearest EMPLOYMENT EXCHANGE, mentioning No. A6253. 5894

DISTRICT Engineer required, experienced in O.H. line work, and with good knowledge of plant on consumers' premises, &c.—Apply, stating all particulars and wage required, to SCOTTISH CENTRAL ELECTRIC POWER CO., 1, Kirk Wynd, Falkirk. 2877

DRAUGHTSMEN (Apparatus), required immediately by Controlled Establishment in London area, with good experience of telephone instruments and kindred apparatus, and magnetos for spark ignition. No person already engaged on Government work need apply.—Apply, stating age, experience and salary required, to your nearest EMPLOYMENT EXCHANGE, mentioning No. A6254. 5896

DRAUGHTSMAN required for Dynamo and Motor Manufacturers, Manchester district (controlled firm). No one on Government work will be engaged.—Apply, stating fully experience, age, when free, and salary, to your nearest EMPLOYMENT EXCHANGE, mentioning No. A 6392. 3184

DRAUGHTSMAN wanted, first class, quick and accurate, accustomed to instrument and electrical work, wiring, diagrams, and small machinery. No man on Government work, or residing more than 10 miles away, can be engaged.—Reply REID BROS., ENGINEERS, LTD., 12, Wharf Road, City Road, N. 1. 6025

DRIVER Attendant wanted for A.C. turbine plant, for a factory in the North of England.—Apply giving experience, 3041, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRIC Fitters.—Several first-class men wanted at once; permanency if suitable. Full rates. No person resident more than 10 miles away, or already on Government work, will be engaged.—W. D. WILLSON, 85, High Street, Croydon. 'Phone 319. 6039

ELECTRIC Lamps.—Technical Assistant required to supervise orders through the factory; previous experience preferable. No one resident more than 10 miles away, or already on Government work, need apply.—Apply EDISON SWAN CO., Ponders End. 3177

ELECTRICIAN wanted by a large industrial concern near London. Must have good all-round experience in maintenance work and extensions, accustomed to repairs to motors, switchgear, and modern electric light installations; good prospects for the right man.—Reply, giving full particulars of experience, references and wages required, to 3160, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ENGINEER of Methods, for Planning Department, required immediately by Controlled Establishment in London area, 2,000 employés, for small and accurate repitition parts of electrical instruments. Electrical knowledge essential. Applicants must be first-class mechanics, and be able to organise a growing department. Preference given to one with knowledge of piece rates. Only applicants having held a similar position need apply. No person already engaged on Government work need apply.—Apply, stating fully, experience, age and salary required, to your nearest EMPLOYMENT EXCHANGE, mentioning No. A6255. 5895

ENGINEER, with first-class mechanical and electrical training, wanted for estimating and contracts by large electrical and manufacturing company in Midlands. No person already on Government work will be engaged.—Apply, giving experience, salary required, and when can commence, to your nearest EMPLOYMENT EXCHANGE, quoting No. A6383. 3186

EXPERIENCED Foreman or Forewoman required to take charge of flashing and mounting department, carbon filaments. No person resident more than 10 miles away, or already on Government work, will be engaged.—9728, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

FITTER (mechanical) wanted.—Apply with full particulars of experience, stating age, and enclosing copies of testimonials, to NORTHAMPTON ELECTRIC LIGHT & POWER CO., LTD., 25, Bridge Street, Northampton. 3214

FITTER required in Central Station. Previous knowledge desirable of turbines and other central station plant. Wages 10½d. per hour, plus bonuses.—Apply 50, Eden Grove, Holloway, N. 7. 5979

FITTER required with a knowledge of turning, for a London central station; previous experience in turbine and large reciprocating engine repairs; wages 1s. per hour, plus bonuses.—6021, ELECTRICAL REVIEW, 4, LudgateHill, London.

FOREMAN Electrician wanted, used to supervision of men engaged on all classes of electrical work. No person already on Government work will be engaged.—Apply nearest EMPLOYMENT EXCHANGE, stating experience, salary, &c., and mentioning No. A6280. 5877

FOREMAN wanted, by large electrical concern, to take charge of manufacture of electrical meters and instruments for industrial purposes. Applicant must be able to supervise both male and female labour on machining and assembling operations, fix piecework prices, and have had experience in a responsible position on similar work. Permanent and progressive position. No one already on Government work will be engaged.—Apply with particulars of experience, age and salary required, to your nearest EMPLOYMENT EXCHANGE, mentioning A6123. 3113

FOREMAN wanted for Electrical Instrument Department of old-established firm; must be well up in construction and production. No person resident more than 10 miles away, or already on Government work, will be engaged. Apply, stating age, experience and salary required, which will be treated in strict confidence.—6028, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

GENERAL Assistant in electrical repair shop, capable of attending to power and light maintenance; if able to drive light lorry (Wolseley) an advantage. No person resident more than 10 miles away, or already on Government work, will be engaged.—Apply TOWNSEND, 10, Bush Lane, E.C. 3205

IMPROVER wanted in a 3-wire D.C. generating station.—Apply, in first instance, to 3162, ELECTRICAL REVIEW, 4, Ludgate Hill, London, stating age, training and wages expected.

(*Continued on next page.*)

SITUATIONS VACANT.—*Continued.*

INSTRUMENT Makers, Tool Makers, and Setters wanted for urgent Government work; also Floor Inspector. Must be first-class men. No person resident more than 10 miles away, or already on Government work, will be engaged.—Address FULLER ACCUMULATOR CO., LTD., Grove Road, Chadwell Heath. 3104

INSTRUMENT Repairer required for repairs to meters and electrical instruments. Good small lathe hand essential, used to accurate work. Wages 10½d. per hour, plus bonuses.—Apply in writing, giving particulars, 50, Eden Grove, Holloway, N. 7. 5980

JOINTER-Wireman wanted for high and low-tension cables; able to do own plumbing; one with experience of car wiring preferred.—Applications with experience, salary required, when at liberty, and enclosing copies of testimonials, to RHONDDA TRAMWAYS CO., LTD., Porth, Glam. 6013

LONDON electrical switchgear manufacturers require Progress Engineer, to watch that machine shop and bought-out parts required by various assembly departments are ready when required. No person resident more than 10 miles away, or already on Government work, will be engaged.—State fully, experience, age, salary required, 6049, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

LONDON Manufacturing Firm require Switchgear Draughtsmen. No person on Government work, or living more than 10 miles away, engaged.—Apply, stating age, experience and salary required, to 6001, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

METER Repairer and Tester wanted. State experience, age and wages required. References required.—ELECTRICAL ENGINEER, Corporation Electricity Works, Grimsby. 3059

RATE Fixer required immediately by Controlled Establishment in London area, with experience of coil winding and small assembly work. Only those with first-class mechanical knowledge need apply. No person already engaged on Government work need apply.—Apply, stating age, experience and salary required, to your nearest EMPLOYMENT EXCHANGE, mentioning No. A6256. 5893

REPRESENTATIVE required immediately for a firm of Engineers in London. Applicant should have a good connection amongst Contractors, Stores, and other Buyers of all Electrical Goods. No person resident more than 10 miles away, or already on Government work, will be engaged.—3212, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

REQUIRED, Draughtsman in Central Station, mechanical training desirable. Wages £2 15s. plus bonus.—Apply in writing giving particulars, 50, Eden Grove, Holloway, N. 7. 5978

REQUIRED, Engineer's Fitter, experienced in the maintenance of Babcock, Wilcox and Dry-back Boilers, Reciprocating and Turbine Engines and Auxiliary Plant of Electric Power Station. No person already engaged on Government work need apply.—Call your nearest EMPLOYMENT EXCHANGE, quoting No. A 6290. 3071

REQUIRED immediately, a Capable Man for testing, recalibration and repairs of A.C. and D.C. Meters and Instruments generally.—Apply, with full particulars of experience together with salary required, to GENERAL MANAGER, Power Station, Downing Street, Smethwick. 3092

SEVERAL experienced Magneto Testers wanted. Good position for reliable men. No person on Government work will be engaged.—Apply your nearest EMPLOYMENT EXCHANGE, mentioning A6316. 3101

SHIFT Engineer required for certified undertaking engaged on munitions work. Experience on Babcock & Wilcox boilers, turbo-generators and E.H.T. 3-phase supply essential. Salary 65s. (including war bonus) plus 12½ per cent.—Apply, with full particulars of experience, age, &c., to KENT ELECTRIC POWER CO., Railway Street, Chatham. 5965

SHIFT Engineer wanted at once for power station. Experience of E.H.T., A.C., also D.C. supply essential.—Apply, stating particulars of age, previous experience, salary required, with copies of recent testimonials, to RHONDDA TRAMWAYS CO., LTD., Porth, Glam. 6014

SIX Men required, used to good class switch work; also six Armature Winders. No person resident more than 10 miles away, or already on Government work, will be engaged.—J. STONE AND CO., LTD., Deptford, London, S.E. 2944

SMART and reliable Estimator's Assistant required on switchgear junction boxes, distribution pillars, &c., for munition works within 10 miles of Liverpool. Must be able to read drawings correctly, and have good knowledge of shop costs. No man on Government work need apply.—Apply your nearest EMPLOYMENT EXCHANGE, mentioning this paper and No. A6391. 3187

SWITCHBOARD Attendant.—Switchboard Attendant wanted, with experience in charge of A.C., H.T. and D.C. traction supply. Wages 62s. per week of 6 shifts of 8 hours, including all bonuses to date.—Apply with reference, and stating experience, to CHIEF ENGINEER, Bournemouth & Poole Electricity Supply Co., Ltd., Verulam House, Bournemouth. 3176

SWITCHBOARD Attendants for station in Manchester district. Apply, with copies of testimonials, stating age, wage and experience, 3191, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

SITUATIONS VACANT.—*Continued.*

TELEPHONE Engineer required at once, knowledge of intercommunicating systems essential, and used to the control of men. Applications by letter giving full particulars of experience, &c. Good position and prospects to right man. No person resident more than 10 miles away, or already on Government work, will be engaged.—6003, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

TEST Room Assistant wanted for general testing by switchgear manufacturers (Tyneside). No person already employed on Government work will be engaged.—Apply by letter, stating age, wages, experience, &c., to your nearest EMPLOYMENT EXCHANGE, mentioning this paper and No. 3178.

WANTED, an Electrical Engineer, for a large Manufacturing Works in the Midlands; a first-class man able to undertake repairs to motors, up-keep, and lighting, and also undertake any additional wiring or setting down of motors; first-class man will have every encouragement, permanent situation; full particulars of experience and present and past employers; hours 6 to 5.30. Wages £5 5s. per week including bonus.—3143, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, at once, Electrician, experienced in petrol electric vehicles and C. A. V. lighting sets. No person engaged on Government work need apply.—Apply your nearest EMPLOYMENT EXCHANGE, mentioning No. A6375. 5998

WANTED, by a firm in the S.E. district engaged on munition work, first-class Telegraph Mechanics. No person resident more than 10 miles away, or already employed on Government work, will be engaged.—State age and experience to 6125, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, by leading engineering insurance company, Electrical Surveyors, having good knowledge of the theory and practice of alternating and direct current plant. Applicants must be ineligible for the Army or Navy.—2581, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, capable Charge Hand Erector for electrical installations, including auxiliary plant. No person resident more than 10 miles away, or already on Government work, will be engaged.—3211, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, experienced Diesel Engine Drivers.—Men willing to train should also apply to LEATHERHEAD ELECTRICITY WORKS, Leatherhead. 5981

WANTED for large Shipbuilding Establishment in Birkenhead district, two Armature Winders and two Electrical Instrument Makers. Good wages, plus 12½% bonus. No person already employed on Government work will be engaged.—Apply to your nearest EMPLOYMENT EXCHANGE, quoting reference No. A6397. 3183

WANTED, for urgent Government contracts, Instrument Makers; must have had experience with both moving coil and moving iron types of ammeters and voltmeters, for factory in N.W. district. No one already engaged on Government work, or residing more than 10 miles away, need apply.—Send full particulars to 3049, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, General Hand for truck repairs; knowledge of wheel-press, overhauling and changing armatures essential. Wages 53s. 6d. per week of 56 hours.—Apply GENERAL MANAGER, Dover Corporation Tramways, Town Hall, Dover. 3065

WANTED, good, all-round Fitter and Works Foreman, for small station. Good wages and permanency for suitable man. Comfortable post, excellent house on premises.—Apply, with testimonials, &c., to BOROUGH ELECTRICAL ENGINEER, Corporation Electricity Works, Bury St. Edmunds. 3180

WANTED, permanent Wiremen. Supply undertaking in the Midlands. Rate 1s. 3d. per hour, including all bonuses.—Reply, stating age and experience, to 3215, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WIREMAN, experienced in ships and works lighting and power installations. No person already on Government work will be engaged.—Apply, stating experience, &c., to nearest EMPLOYMENT EXCHANGE, mentioning No. A6280. 5878

WIREMAN wanted; power A.C., D.C. and lighting. Good all-roundman: permanent job. No person resident more than 10 miles away, or already on Government work, will be engaged.—Apply by letter, JAMES EVANS & CO., 2, Scott's Yard, Bush Lane, E.C. 3206

WIREMEN wanted for London district. No person resident more than 10 miles away, or already on Government work, will be engaged.—Apply F. G. EDEY & CO., LTD., 25, Warwick Lane, Newgate Street, E.C. 4. 5993

YOUNG Electrical Assistant required for drawing office; knowledge of solenoid and resistance design essential. No person resident more than 10 miles away, or already on Government work, will be engaged.—3197, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

(Continued on next page.)

APPOINTMENT FILLED.

BOX 3116 : Charge Engineer. Correspondents are thanked for their applications. Position is now filled. 3217

SITUATIONS WANTED.

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Box Number and ELECTRICAL REVIEW address count as seven words.

AQUALIFIED Electrical and Mechanical Engineer desires a position as Inspecting Engineer or position of similar importance. Many years in this particular line.—5902, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ACCOUNTANTS, undertake income tax, balance sheets, book-keeping ; moderate.—53, Crayford Road, London, N. 7. 5934

ADVERTISER wishes engagement as Electrician or Supervisor, power, lighting, or factory.— G., 137, Sulgrave Road, Hammersmith, W. 6. 5910

ADVERTISER, young man, 29, recently discharged H.M. Forces, with exceptional experience Wholesale Electrical Supplies Trade, seeks responsible position with firm of repute. Prior to enlisting, Secretary to well-known London Wholesale House. Would open London Branch, Wholesale Department, or act as Sales Manager, Buyer, &c., for progressive concern ; capable organiser, thoroughly experienced company work, office management, and control of staff.—Write, R. C. TOOGOOD, 6, Madeira Road, Leytonstone, Essex. 6047

ADVERTISER (35), A.M.I.E.E., desires change ; chief draughtsman, development, or position of responsibility ; 15 years' experience in design of switchgear, switchboards and control gear ; C. and G. Hons. Certificate Electrical Engineering.—6037, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ALL-round Engine Fitter (practical) seeks situation in small firm on engines (internal, gas, steam, oil), or shop on small parts. —5868, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

AN Electrical Engineer, holding responsible position, with full technical and workshop qualifications, can shortly be at liberty. Large experience in high-tension and low-tension power and sub-station installations, running of plant, designs of switchgear, and cabling.—5904, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

AN Electrical Engineer, well versed in all Admiralty practices on H.M. ships, and at present employed in one of H.M. principal dockyards, desires an equivalent position where ability and zeal are not hampered by red tape.—5952, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ASSISTANT Resident Engineer of Electric Power Co., desires position abroad ; Public School and University.—6011, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

CHARGE Engineer desires permanent post ; 16 years' sound experience, A.C. and D.C., &c,—Mr. B., c/o Baldwin, 47, Cliffe Street, Keighley, Yorkshire. 5928

COMPETENT Electrician desires charge of installation. Southern Counties.—5948, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICAL and Mechanical Engineer desires post as Inspector or Charge of Test Room ; well up in small motor, switchgear and projector work ; 15 years' experience.—5960, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICAL and Mechanical Engineer, fully qualified, requires post in Australia or Colonies ; complete equipment and installation of works, or factory plant maintenance and management, A.C. and D.C. machinery, Diesel and turbine engines.—6044, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICAL and Mechanical Engineer, shortly disengaged, seeks post as Manager or Foreman ; 15 years' experience shipyard, Admiralty and factory supervision ; used to handling large numbers of men and all classes of electrical and mechanical plants and machinery. Thorough business training.—6005, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICAL Engineer, knowledge petrol paraffin engines, car lighting and accumulator manufacture, desires post.—6019, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICAL Engineer, with mechanical training, shortly disengaged, desires an appointment where ability and initiative are appreciated ; charge of works plant or similar capacity. Commencing salary £5 per week ; discharged service.—5918, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICAL Engineer, with wide and varied experience in lay out, erection and maintenance of large power and lighting plants, accustomed to control a large number of men, desires a responsible position on Government work.— 5975, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

SITUATIONS WANTED.—*Continued.*

ELECTRICIAN (aged 32), 15 years' experience on installations and maintenance of factory, also thorough experience in handling Colonial labour, speaking all languages, seeks situation. Palestine preferred. France, Russia, Italy, Belgium, and Balkan States, where applicant lived, considered. First-class references. —E.B., 51, Sunnyhill Road, Bournemouth. 6032

ENERGETIC Electrical and Mechanical Engineer desires technical or commercial position. Varied experience, including estimating and purchasing of plant, &c.—6030, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ENGINE Fitter (47) seeks berth as Foreman or Charge Hand, general, aero, gas, steam, or shop, on small parts.—5867, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ENGINEER, aged 30, desires change, supervising contract work or Branch Managership ; Midlands or North Wales ; 10 years supervisor transmission lines, cables, collieries, town lighting, conversant in handling large bodies of men, could introduce good work after war.—6018, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ENGINEER, A.M.I.C.E., A.M.I.E.E., with 13 years' practical experience, including instrument and experiment work, is free for suitable engagement.—5977, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ENGINEER, energetic, with 12 years' practical and commercial experience, desires position in Development and Publicity Department, or as Consumers' Engineer.—6022, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ENGINEER - Electrician, experienced, seeks charge of country house plant or Institution. Steam, oil or gas plant.—6033, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

HEATING and Cooking Apparatus.—Engineer, formerly commercial manager for prominent makers, is now free to resume either commercial or productive work.—6010, ELECTRICAL REVIEW, 4, Ludgate Hill, London

JOINTER, used to general mains work, motors, meters, locating faults, &c.—Apply W. C., 12, Mortimer Terrace, Highgate Road, London, N.W. 5. 5883

LAD (15) seeks vacancy as electrical Wireman's Mate ; slight experience.—143, Ilderton Road, North Camberwell. 6036

LADY Shorthand-Typist desires change to South country (not London) ; 8½ years' experience ; present position over four years.—5967, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

MANAGER or Works Manager, shortly disengaged, 26 years' works experience, electrical instruments ; practical, energetic, and good organiser, will take financial interest ; can introduce new post war lines.—5945, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

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SHOP Engineer, Assistant Works Manager, or other suitable position, required now or post War by University-trained Electrical Engineer, aged 29. Four years technical design Alternators and Induction Motors ; 14 months Assistant Electrical Engineer, H.M. Factory. Test house, power house records and accounts, workshop supervision, technical editorial experience. Knowledge French and Publicity.—5955, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

TECHNICAL Engineer, with long experience in instrument design, testing and output control, desires to get in touch with reputable firm, with view to engagement in responsible position.—6007, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

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WIREMAN, used screwed tubing, repairs, testing, lighting, bells, arcs, factory work, desires permanency, London.— 6008, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WORKS' Manager seeks berth ; 13 years' practical and theoretical experience in supervising of winding shop ; knowledge of small motors, fans, &c., unique ; just disengaged. London district or South Coast preferred.—5903, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

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(Continued on next page.)

PARTNERSHIPS.

ENGINEER (manufacturing electrical), with £5,000, requires Active Directorship in a well-established works; London or provinces.—ARNOLD & Co. (LONDON), Ltd., 143, Cannon Street, E.C., Agents. Established 1891. No result, no charge. 3216

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OOSTERHUIS BROS., ARNHEM (HOLLAND).

DUTCH Electrical and Technical, wholesale and export firm, wants connections with manufacturers and buyers all over the world. 6026

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Box Number and ELECTRICAL REVIEW address count as seven words.

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WELL-known electrical firm is open to consider an agency for high-class electrical plant for Lancashire district.—3201, ELECTRICAL REVIEW, 4, Ludgate Hill, London

FOR SALE.

GAS ENGINE FOR SALE.

NUREMBERG Type, Makers Fraser & Chalmers, 460-B.H.P., rope-driven Dynamo (G.E.C.), 250 KW., 440 to 550 volts.

3179, ELECTRICAL REVIEW,
4, Ludgate Hill, London, E.C. 4.

FOR SALE.—*Continued.*

MACHINERY FOR SALE.

SCREW-driven Planing Machine, to plane 14′ by 4′ by 4′, by Hulse & Co.

No. 3 Four-spindle "Acme" Automatic Screw Machine, for ⅝″ bars.

Nearly new "Victor" Automatic Turret Lathe, by Smith and Coventry, 9″ centres, 8′ bed, 2¼″ hollow spindle.

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Horl. Boring and Facing Machine, by Noble & Lund, T-slotted table, 2′ by 2′ 2″.

Portable Electric-driven Saw Bench, table 48″ × 22″, to take saws 30″ diam., 7½-B.H.P. Motor, 440 volts.

CATALOGUE of Stock MACHINERY, 2-3000 LOTS. Free on Application. Inspection invited.
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ONE 500-KW. triple-expansion Set, engine by Browett and Lindley, H.P. cyl. 17½″, I.P. 25″, L.P. 35″ × 14″ stroke. Single-phase Alternator, by British Westinghouse Co., 2100 volts, complete with exciter, &c.

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One Willans-Parsons Steam Turbo Set, 1200 KW., with Alternator, 1200 R.P.M., 200 lbs. to sq. in., 11,000 volts, three-phase, complete with exciter, also condensing plant, air, and circulating water pumps, &c.

One Surface Condenser, by J. & H. McLaren, capacity 3000 cls. per hour, with circulating pump.

Two Exciters, 180 volts, 80/100 amps., 200 R.P.M. 5277

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250-KW. Belliss-E.C.C. Set, 460 V., D.C.
225-KW. Willans-Siemens Set, 410 V., D.C.
75-KW. E.C.C. Machine, 110 V., D.C.
Electric Sinking Pump, 20 H.P., 220 V., D.C.
30-H.P. Laurence-Scott Motor, series wound, 460 V., D.C.
20-KW. Machine, 205 V., D.C.
Motor-Generator Set, 230 V., 30 amps., to 55/80 V., D.C.
31-H.P. Siemens S.C. Motor, 500 V., 3-phase, 50 cycles, 1,450 R.P.M.
600-H.P. E.C.C. Motor, 2,000 V., 2-phase, 50-period, 730 revs.
450-K.V.A. Generator, 110 V., single-phase, 25 cycles, 730 R.P.M.
D.C. and A.C. Starters.
Ammeters, Cable.

BURY ELECTRICAL PLANT CO., LTD.,
Monitor Works,
Bury.
'Grams: "Electric Bury." 'Phone: 676 Bury. 3131

ELECTRICAL PLANT FOR SALE.

ONE 300-KW., 220/250-volt Generating Set, comprising "Howden" enclosed compound engine, coupled to compound interpole Generator.

One 500-KW., 220/250-volt Generating Set, comprising "Belliss" enclosed compound engine coupled to compound-wound Generator, and complete with condensing plant.

One 450-KW., 500-volt Set, as above, with or without condensing plant.

THE PHŒNIX ELECTRICAL CO.,
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Glasgow. 2429

OIL ENGINE AND MOTOR.

11½-H.P. Horizontal Oil Engine, by Gardner for sale, not yet removed from makers' case; immediate delivery can be given, and no certificate is required.

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5889, ELECTRICAL REVIEW, 4, Ludgate Hill, London, E.C. 4.

(*Continued on next page.*)

FOR SALE.—*Continued.*

FOR SALE.

Delivery from Stock.

110 VOLTS.

One 5·5-KW. Shunt Dynamo, 1050 R.P.M.
One 30·5-KW. Comp. " 850 R.P.M.

220/250 VOLTS.

One 1/17-H.P. Series Motor.
One 1/7-H.P. Shunt " 1900 R.P.M.
One 1/6-H.P. " " 1725 "
Three ¼-H.P. " " 1600 "
Three ½-H.P. " " 1600 "
Three 1-H.P. " " 1400/1600 "
Eight 2-H.P. " " 1300 "
Five 3-H.P. " " 1200 "
One 10-H.P. " " 1000 "
Three 12½-H.P. " " 1225 "
One 15-H.P. " " 950 "
Two 20-H.P. " " 700 "
One 29-H.P. " " 940 "
One 30-H.P. " " 1120 "
Two 35-H.P. " " 870 "
Two 38-H.P. " " 580 "
One 41-H.P. " " 1050 "
One 45-H.P. " " 720 "

All new machines.

400/440 VOLTS, A.C., 50 CYCLES.

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Six 1-H.P. Squirrel Cage, 700/1400 R.P.M.
One 1½-H.P. " " 1420 "
One 1½-H.P. " " 1400 "
One 1¾-H.P. " " 1400 "
Seven 2-H.P. " " 1400/1440 "
One 2½-H.P. " " 950 "
One 3-H.P. " " 940 "
One 4-H.P. " " 1400 "
One 5-H.P. " " 1430 "
One 8-H.P. " " 1440 "

400/440 VOLTS, A.C., 25 CYCLES.

One 4-H.P. Squirrel Cage, 715 R.P.M.

440/500 VOLTS, D.C. Machines.

One 1-H.P. Shunt Motor, 1750 R.P.M.
One 2-H.P. " " 2000 "
One 2-H.P. " " 1400 "
One 2-H.P. " " 1185 "
Two 4-H.P. " " 1100/1300 "
One 5-H.P. " " 1275 "
Two 5-H.P. " " 1000 "
One 5-H.P. " " 1430 "
One 5-H.P. " " 1370 "
Three 7½-H.P. " " 750/1350 "
One 8-H.P. " " 1030 "
One 10-H.P. " " 320/960 " variable speed.
Two 10-H.P. " " 1050 "
One 12-H.P. Series " 1000 "
Five 12-H.P. Shunt " 820/830 "
Two 12½-H.P. " " 1270 "
Nine 14-H.P. " " 820/980 "
One 15-H.P. " " 1100 "
One 25-H.P. " " 1175 "
Two 25-H.P. " " 880/1000 "
One 26-H.P. " " 750 "
One 30-H.P. " " 500/1000 " variable speed.
One 35-H.P. " " 1000 "
One 38½-H.P. " " 725 "
One 40-H.P. " " 900 "
One 43½-H.P. " " 675 "
Two 48-H.P. " " 775 "

All new machines.

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300/350 A.C. and D.C. Starters, oil-immersed, and Star Delta.

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Large stock of Ironclad 2 and 3-pole Switches, 10/500 amps., Totally enclosed Mining Pillars up to 550 volts, Circuit Breakers, B.O.T. Meters, Watt-hour Meters, Cables, Fuse Boards, &c., &c.

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Telegrams: "Commutator, Glasgow." 3199

MACHINERY FOR SALE.

ONE Generating Set Comprising:—

"Howden" Enclosed Compound Engine for 150 lbs. steam pressure, direct-coupled to compound interpole generator, having an output of 300 KW. at 240 volts, 375 r.p.m.; built in 1910, and in first-class order.

Specification and print on request.

THE PHŒNIX ELECTRICAL CO.,
32—36, Broomielaw, Glasgow. 1943

FOR SALE.—*Continued.*

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One practically new Mond Gas Producer, 1200 B.H.P. continuously, for supplying Mond gas for driving gas engines, and supplying gas for furnaces, complete with Coal Handling Plant. Available now.

Three 105-KW. Hindley 5-cylinder vertical Gas Engines, direct coupled to 500-volt D.C. Generator. Available now.

Two 180-KW. do. do., in process of manufacture.

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Two 205-B.H.P., 500-volt Motors, 290 revs., suitable for direct coupling to Compressors.

One compound-wound Generator, 310 amps., 240 volts, 540 R.P.M.

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12-VOLT DYNAMO, 750 amps., two Commutators, 1150 revs. Almost new. Makers: Canning & Co.

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Transformer, 3-phase, 500 to 220 volts, 50 periods; output, 15 K.V.A. continuously. Secondary pressure can be changed easily to 110 volts. Makers: Ferranti.

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55 yards double-wire armoured, 19/16, three-core Cable, Association; 2500 megohm grade.

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18 Jandus enclosed Arc Lamps.
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1,100 10 in., 16 m/m (cored).
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TREDEGARS LTD., 5/7, Brook Street, W. 1. 3194

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MAGNIFICENT 500-H.P. Horizontal Tandem Gas Engine, together with 350-KW. Alternator, by G.E.C., 230 volts, three-phase. Price £2,500. Set will be sold separately if desired.

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JOHN F. WAKE, Engineer, Darlington. 3145

CABLE, &c., FOR SALE.

12 MILES 1/18 Cable; 20 miles 3/22 Cable. Ironclad Switches and Fuses, all amperages; 1200 G.G.S.C. Holders, 1000 s/c Batten Holders; Motors, all sizes and voltages. All ex stock for London delivery only.—3185, ELECTRICAL REVIEW, 4, Ludgate Hill, London, E.C. 4.

(Continued on next page.)

FOR SALE.—*Continued.*

MACHINERY FOR SALE.

1000-KW. Turbo-Generator, A.E.G., 500 volts, 50-period, 3-phase, complete with two switch panels, surface condenser, electrically-driven air and circulating pumps, together with the piping and a quantity of new spare parts. The whole practically equal to new and ready for immediate despatch at Liverpool.

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Also 500, 256, 200, 185, 160, 120 and 48-KW. Belliss Generating Sets, 460/500 volts and 200 volts, D.C.

One Crompton, 150 H.P., 25 periods, 3-phase, slip-ring.

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All the above are ready for immediate despatch.

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NEW A.C. Electric Motors, protected slip-ring type. Guaranteed for 12 months.

No. of Machines.	Phase.	Volts.	Periods.	R.P.M.	H.P.
Two	2	220	40	800	14
Two	,,	200	50	1000	10
Three	,,	220	40	800	20
Three	,,	200	50	1000	17
One	,,	220	40	800	25
One	,,	200	50	1000	20

CRYPTO ELECTRICAL CO., LTD., Acton Lane, Willesden, N.W. 10. 3189

LAMPHOLDERS, LAMPS, &c.

FOR Sale at reasonable prices, from stock, Lampholders, Metal Filament Lamps, Switches, Cables, Delcoblast Lamp Obscurer, &c., &c.

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ELECTRIC DYNAMOS AND MOTORS.

MACHINES always available for Sale or hire. ARMATURES and FIELD COILS rewound or repaired without delay.

'Phone: 5773 Holborn. MACDONALD, SYER & CO., LTD., 295, Gray's Inn Road, W.C. 1. 8485

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250-KW. Belliss-E.C.C. Set, comprising Belliss high-speed, 3-crank, compound engine, direct-coupled to E.C.C. generator, 440/460 volts, D.C., 560 amps., 380 R.P.M., with Körting ejector compound, also spare armature. Can be seen running by appointment.—BURY ELECTRICAL PLANT CO., LTD., Phœnix Street, Bury. 2746

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MOTORS, ready for immediate delivery: 15 H.P., 220 v., 900 R.P.M.; 10-H.P. Wright & Wood, 220 v., 900 R.P.M.; 8-H.P. Woolnough, 220 v., 1100 R.P.M.; 5-H.P., 220-v., 1000-R.P.M.; 7-H.P. Crompton, 440 v., 900 R.P.M.; 5-H.P. Zone, 440 v., 1500 R.P.M.; and several smaller. Also 14 A.C. Motors.—E. P. ALLAM & CO., 107/109, Gray's Inn Road, W.C. 1. Holborn 1280. "Epaltrical, London." 3166

PORTABLE ELECTRIC MOTORS.

TO RUN either A.C. or D.C. Great mechanical strength and simplicity. Size $10\frac{1}{16}$" × $4\frac{1}{2}$". Weight 10 lbs. H.P. $\frac{1}{4}$—$\frac{1}{2}$. Most powerful for size and weight yet designed. Prices and particulars from the Agent—

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3203, ELECTRICAL REVIEW, 4, Ludgate Hill, London, E.C. 4.

CUNNINGHAM, LIMITED.

SMALL Motors and up to 300 H.P. rewound and repaired.

Estimates free. 'Phone: "5173 Padd." 171, Edgware Road, London, W. 2.

FOR SALE.—*Continued.*

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BRUSH-Holders, box type, about 2,000, for Sale.—140, Southwark Street, S.E. 5989

D.C. Motors, 230 v., $\frac{1}{3}$, $\frac{1}{2}$, $\frac{3}{4}$, 1, $1\frac{1}{2}$, 2, 3, 5, 6, 8, 10, 12, 20, 40 H.P. Motors, 460 v., $\frac{1}{2}$, 1, 2, $3\frac{1}{2}$, 5, 6, 10, 12, 20, 40, 150 H.P. Motors, 110 v., $\frac{1}{4}$, $\frac{1}{2}$, 1, 2, 4, 5, 6, 7, 8, 10, 11, 15, 20, 25 H.P.—6041, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

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DYNAMO, Parker, 100 v., 40 a, 1150 R.P.M.—WHITE, 140, Southwark Street, S.E. 5991

DYNAMOS, 200/250 v., 15, 60, 100, 450, 650 amps. Dynamos, 110 v., 18, 26, 30, 40, 50, 60, 70, 80, 90, 100, 125, 520, 920 amps. Several 60/80 v., 60/100 a.—6043, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

DYNAMOS, 3000, 1500, 1000 and 750 amperes at 6 volts; also smaller sizes. Apply for lists.—CANNING & CO., Electro-Platers Engineers, Birmingham. 7769

ELECTRIC Power Station Plant for Sale.—Two 25-KW. belt-driven motor generator sets complete, comprising single-phase A.C. motors, 205 volts, 50 cycles, D.C. generators, 530 volts, four-panel switchboard fitted with switchgear, ammeters, voltmeters, wattmeter, &c., &c. Will be sold complete, or machines singly. To be seen in London, E.C.—For full particulars reply to Box 827, T. B. Browne's Advertising Offices, 163, Queen Victoria Street, E.C. 4. 6006

FOR Sale, a solid brass three-branch Electrolier; fancy design.—5996, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

FOR Sale, about $4\frac{1}{2}$ cwt. 7/22 Silicon Bronze Overhead Wire, new.—THE PHŒNIX ELECTRICAL CO., 32/36, Broomielaw, Glasgow. 3120

FOR Sale, any quantity Dry Batteries. Further particulars, apply CRUICKSHANKS, 18, Renfrew Lane, Glasgow. 5939

FOR Sale, new Motor-Generator, suitable for welding, and comprising: 80-H.P., 440-volt, 35-cycle, 3-phase, slip-ring Motor, coupled to 60-KW., 110-volt, D.C. Generator.—THE PHŒNIX ELECTRICAL CO., 32/36, Broomielaw, Glasgow. 3123

FOR Sale, One-ton electrically-driven Warehouse Hoist (nearly new); jib about 10 ft., 400-volt D.C. Motor, seen working.—WILLIAMS & SONS, 37, Queen Victoria Street, London. 3154

FOR Sale, one $1\frac{1}{2}$-B.H.P. Gardner Vertical Engine (paraffin or petrol), direct coupled to Crypto dynamo, 25/37 v., 15 a.; 14 Exide Accumulators, 140 a.-hour capacity; control by panel switchboard with instruments; one 25-volt pedestal Fan, complete; one 25-volt Vacuum Cleaner; also number of 25-v., 10 and 15 w., lamps. May be seen in London. Price complete £175. Also one $\frac{1}{10}$-H.P., A.C. Motor, 200 v., 50 w.; one $\frac{1}{10}$-H.P. Motor, 200 v., 50 w.; one porthole Fan with regulator, 200 v., 50 w., by G.E.C.—Apply, by letter only, Box 211, ADVERTISING OFFICES, 84, Queen Victoria Street, London. 3036

FOR Sale, Vertical High-Pressure Three-Throw Pump; plungers $7\frac{1}{2}$" by 9" stroke. Driven by steam Engine. Prompt delivery.—WILLIAMS & SONS, 37, Queen Victoria Street, London. 3153

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FOR SALE, 12-H.P., twin-cylinder Oil Engine, by Belliss and Morcom, on bedplate with space for dynamo; price £75. Seven cast-iron watertight Works Bells, with 6 in. gongs; price 30s. each.—LEONARD SATCHWELL, Cartref, Carnglas Road, Sketty, Swansea. 5970

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(Continued on next page.)

FOR SALE.—*Continued.*

FOR Sale, 60-KW., 110-volt, 700-R.P.M., shunt interpole Generator; also 110-KW., 500-R.P.M. ditto, for belt or rope drive.—THE PHŒNIX ELECTRICAL Co., 32/36, Broomielaw, Glasgow. 3118

FOR Sale, 80-H.P., 440-volt, 25-period, 720-R.P.M., 3-phase, slip-ring Motor, complete with Ellison Control Gear.—THE PHŒNIX ELECTRICAL Co., 32/36, Broomielaw, Glasgow. 3124

FOR Sale, 90-KW. modern Generating Set, by Browett, Lindley and Laurence Scott, 220 volts, 410 amps., 450 R.P.M. Engine, compound, developing full load at 160 lb. steam pressure on atmosphere; Generator, 6-pole compound wound; complete with new spare Armature, and ready for immediate delivery.—5888, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

FOR Sale, 110-KW. direct-coupled Steam Generating Set: Siemens type Dynamo, 220 volts. Immediate delivery.—WILLIAMS AND SONS, 37, Queen Victoria Street, London. 3152

FOR Sale, 110-KW., 220-volt, 500-R.P.M., multipolar, three-bearing Generator.—THE PHŒNIX ELECTRICAL Co., 32/36, Broomielaw, Glasgow. 3121

FOR Sale, 180, 220 and 500-H.P., 440/500-volt Motors, all slow speeds.—THE PHŒNIX ELECTRICAL Co., 32/36, Broomielaw, Glasgow. 3119

FOR Sale, 290-KW. Bellis-Silvertown direct-coupled Generating Set, 600 volts, 490 amps., 350 R.P.M.; Generator, 4-pole, shunt-wound; and compound Engine. Complete with spare Armature and Shunt Regulator; enamelled slate Switchboard suitable for above, consisting of generator panel and two feeder panels, with instruments and D.P. circuit breakers, &c. £1250 f.o.r. The above plant is in thoroughly good order, open for inspection, and ready for immediate delivery.—83, The Exchange, Cardiff. 5887

FOR Sale, 996 yd., new, 4-core, 110/24, S.W.G., Cab Tyre Sheathed Cable, in three lengths.—THE PHŒNIX ELECTRICAL Co., 32/36, Broomielaw, Glasgow. 3122

GARDNER 5-horse vetical petrol paraffin Engine for sale, fitted with H.T. Bosch magneto, vaporiser, circulating pump, speed 800, suitable for direct coupling to dynamo, nearly new.—A. RUSHWORTH, Chigwell Row, Essex. 6046

G.E.C. Moving Coil Voltmeter to 50, 8½" dial, dead beat, as new, seal unbroken, 55s. Ten 210-v., 60-w. Osram Lamps, never been used, guaranteed, 32s. 6d. 27 yards 7/14 600-megohm Cable, new, 27s.—105, Loyd Road, Northampton. 5964

HAULAGE Gear, 1 to 6 tons, steam or electric.—BURY ELECTRICAL PLANT Co., LTD., Monitor Works, Bury. 3133

MOTORS.—Two Siemen's Motors for Sale, both 10 H.P., 805 revs., 530 volts D.C. May be seen by appointment in London, E.C.—Reply Box 818, T. B. Browne's Advertising Offices, 163, Queen Victoria Street, E.C. 4. 6015

ONE Carron Electric Oven, hot closet, 30 amps., 200 volts; practically new, £25.—COX-WALKERS, LTD., Darlington. 3125

ONE Horizontal Tandem Compound Engine, 200 I.H.P., 12" and 24" cylinders, 3 ft. stroke.—BURY ELECTRICAL PLANT Co., LTD., Monitor Works, Bury. 3132

ONE 200-KW. Steam Generating Set for immediate sale, Willans-Mather & Platt, 220 or 440 volts. Perfect working condition.—JENNINGS, West Walls, Newcastle-on-Tyne. 1513

PEACE Illuminations.—Electrical Carbon Lamps, pear shape, 2 C.P., 14 volts, miniature screw ends. Stock of all colours; lots 500, assorted. 45s per 100. Cash remittance. Immediate delivery. Sample 8d.—PAUL BRAILLI, Cardiff. 5986

SIEMENS Arc Lamp Carbons; best quality; job line; 20,000 6 to 12 m/m diameter; to be sold cheap.—LAKE, 132, Upper Thames Street, London, E.C. 3209

STORAGE Bells, six, 500-amp. hour, trays and insulators, no glass boxes, good condition, £12.—6045, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

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1/16 and ¼-H.P. Motors, also Vacuum Cleaners, "Imperial" and "Daisy." All 200/220-volt, D.C. Equal new. Cheap, quick sale.—5961, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

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3-H.P., 110-volt, shunt-protected Siemens Motor; speed 1650/1850. Condition as new.—DRUMMOND & Co., Middlesbrough. 5995

6½-H.P. Crompton Electric Motor, 480 volts, 1,350 revs., with pulley, starter, and rails. £47 10s.—FRED AFFLECK, Princes Street, Swindon, Wilts. 6038

FOR SALE.—*Continued.*

14 "METROFLAM" Flame Arc Lamps, 70 hour, arranged for series burning on 200 volts, direct current, spare carbons available; all in thoroughly good condition, by Johnson & Phillips. Offers to DRAKE & GORHAM, 47, Spring Gardens, Manchester. 3218

17-H.P., 440-volt, Shunt Protected Westinghouse Motor; speed 1500. Also 19-H.P. ditto.—DRUMMOND & Co., Middlesbrough. 5906

56-KW., 700-amp. Welding Dynamo, multipolar, belt-driven type, complete with spare armature.—DRUMMOND & Co., Middlesbrough. 5905

150-KW., D.C. Generator, multipolar type, 500 volts, with rope pulley; splendid condition.—HARRY H. GARDAM AND Co., LTD., Staines. 2952

190-H.P., six-pole D.C. Motor, by Ernest Scott & Mountain, 500 volts, arranged for rope drive.—HARRY H. GARDAM AND Co., LTD., Staines. 2827

460-Volt Dynamos or Motors for sale, 120, 163, and 240-amp. sizes.—3139, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

550/600-volt, 3-phase, 50-period, 75-K.V.A. Alternator for sale.—3138, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

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WANTED, a few 400-volt, 50-cycle, 3-phase Motors, preferably slip-ring type, 5 to 35 H.P.—8133, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

(*Continued on next page.*)

ARTICLES WANTED.—*Continued.*

WANTED, direct-coupled Set, about 50/75 KW., 220 or 440 volts, D.C., preferably the latter. Full details and price must accompany offer.—2828, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, Electric Cooking and Heating Apparatus Kettles, Irons, Vaccuum Cleaners, voltage 220.—Apply, with full particulars, to Mr. FRANK EVANS, Engineer, Electric Works, Llangollen. 3029

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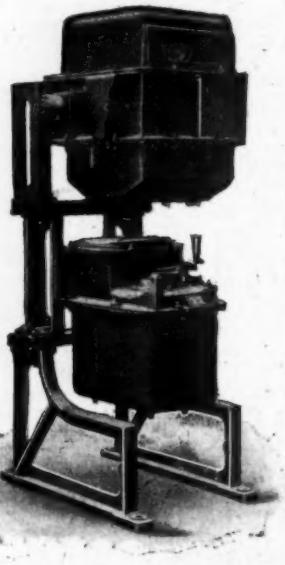

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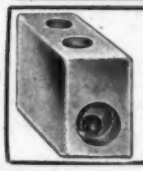

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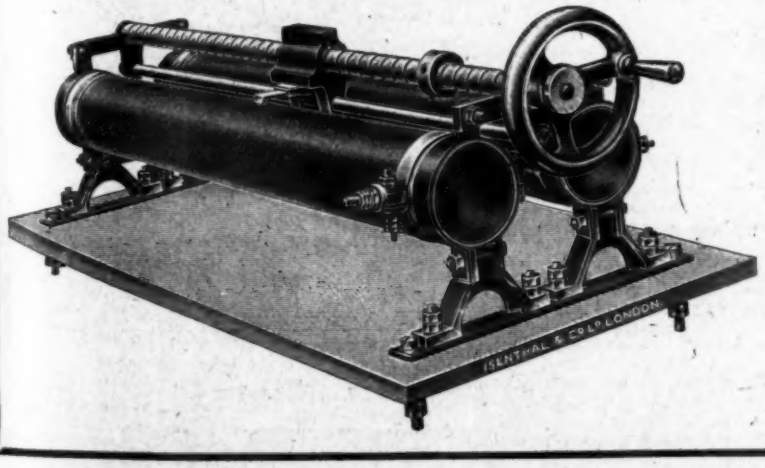

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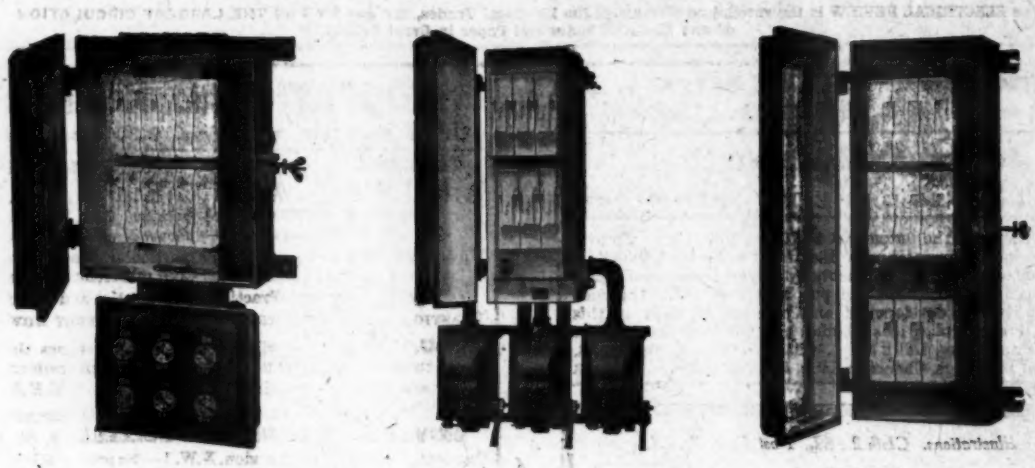

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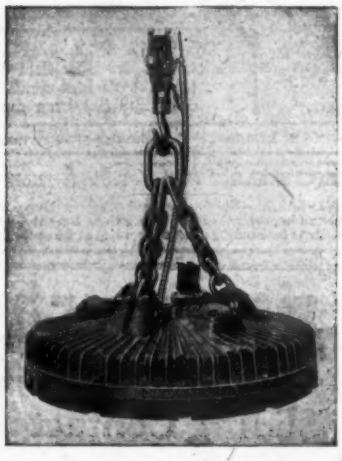

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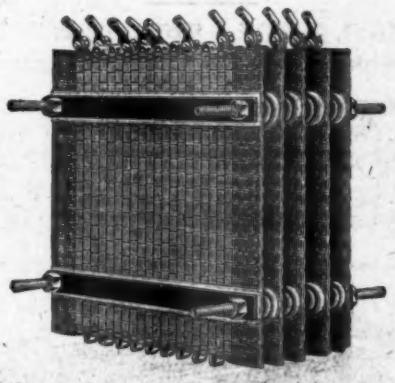

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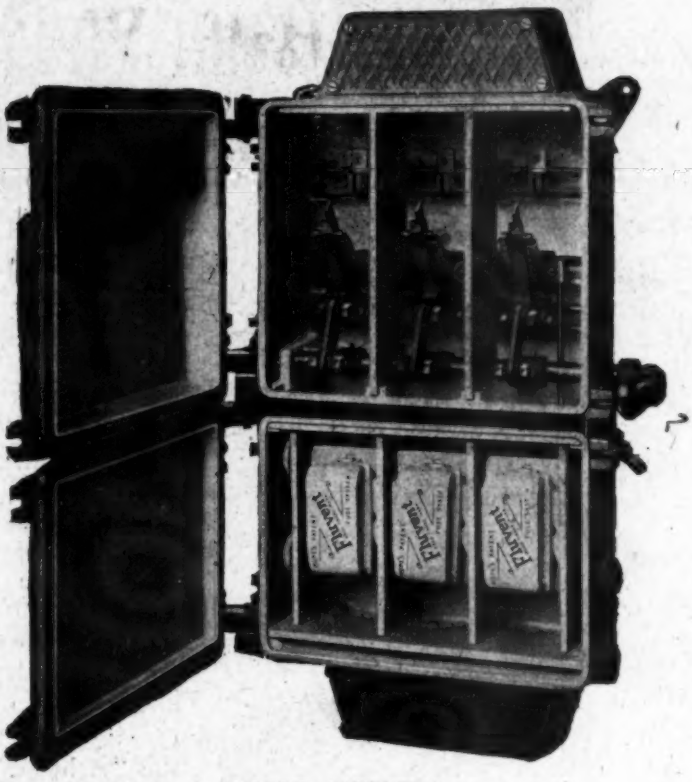

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REGD. TRADE MARK

100-amp. Standard Three-Phase SWITCH-FUSE

is designed on the highest scientific principles of Fuse-Gear, and each part is mechanically strong and perfectly insulated—facts which have enabled this unit to give accurate results—impossible to any other system.

The Switch is mounted on mica-covered steel rods—has a parallel break—all moving parts are lock-nutted and split-pinned—and the switches are fully guaranteed to stand 3,000 volts to earth for five minutes and to give an insulation test of 50 megohms.

The FLUVENT Fuse used can be supplied with Switch either above or below—and the entire unit, in common with all FLUVENT Switch-gear, can be supplied with Gland to suit any class of cable without departing from standard practice.

May we fully explain the FLUVENT System to you?

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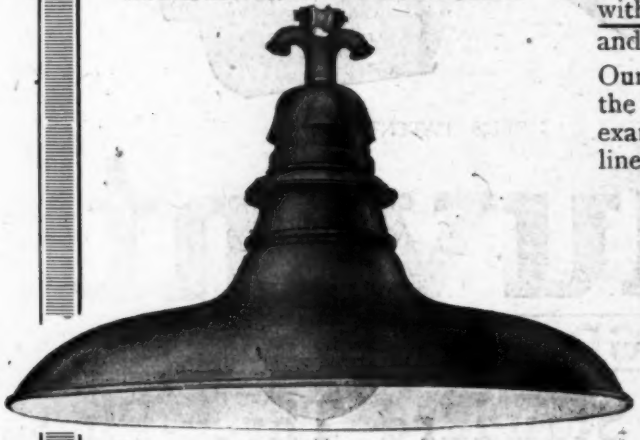
"GUILDFORD" Half-Watt Lantern.
Case of solid copper, oxydised finish.
This fitting can be supplied with round globe if preferred.



"ASHTEAD." Extra Extensive Reflector, for the even illumination of factories and other large areas.

"BOOKHAM."
This attachment contains auto-cutout and sub-resistance, and can be used with existing fittings operating in series.

Now we can deliver Half-Watt Lamp Fittings promptly.

THE Half-Watt Lamp Fittings shown are two of a series we make for street lighting and factory use. Each group consists of a number of designs, one of which is appropriate to your requirements.

Our "Street Lighting" patterns are made of heavy gauge copper, and are of waterproof construction, the lamp being protected from the elements.

These lanterns can be supplied with or without auto-cutouts and substitutional resistances.

Our "Factory" type of which the "Ashtead" Reflector is an example, are made of stout steel lined with porcelain enamel.

But you should write for our Fittings List, as herein all models are shown and described. Please write off at once for a copy. These fittings are made in all sizes, the largest of which takes a Half-Watt Lamp of 1,500 watts. Certain of these can be despatched on receipt of order.

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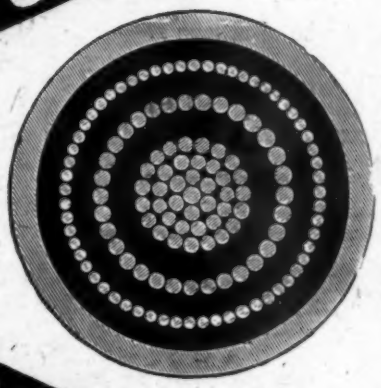

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Repulsion Start—Induction

SINGLE-PHASE MOTORS

being installed on lighting circuits.

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A fuse which will protect under full load is usually of ample capacity for successfully starting the ordinary full load.

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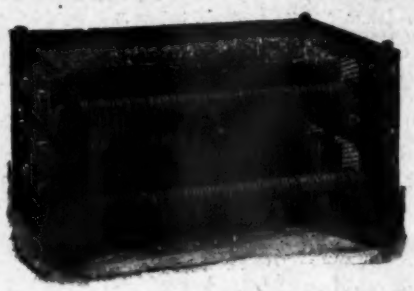

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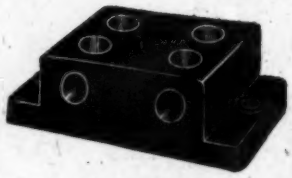

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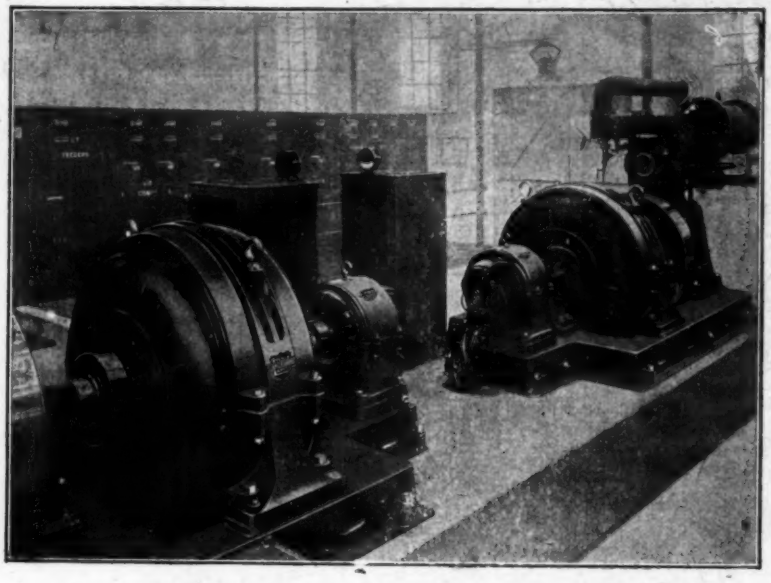

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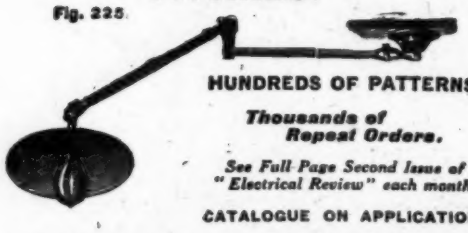
Fig. 225.



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Tungsten Lamps, both ordinary Vacuum and Half-Watt types.

We are in a position to supply at the recognised trade discounts and terms as determined from time to time.

The wide range of makes offered, including Half-Watt Lamps, coupled with our organisation for the prompt handling of both large and small orders, will, we venture to hope, enable us to be of greater service in supplying the general requirements of the trade in Electric Lamps, and, more particularly, to give better all round delivery than is possible with a single make of lamp, having regard to the shortage of supplies arising out of prevailing conditions.

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EFESCA ELECTRICAL WORKS
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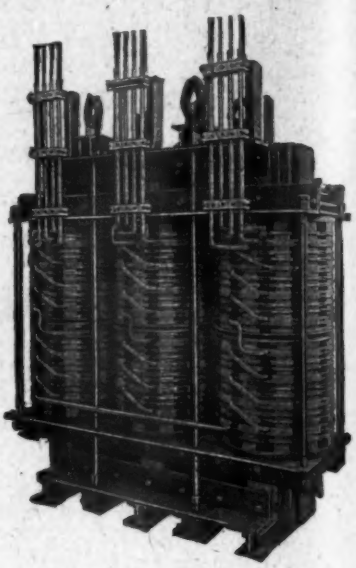
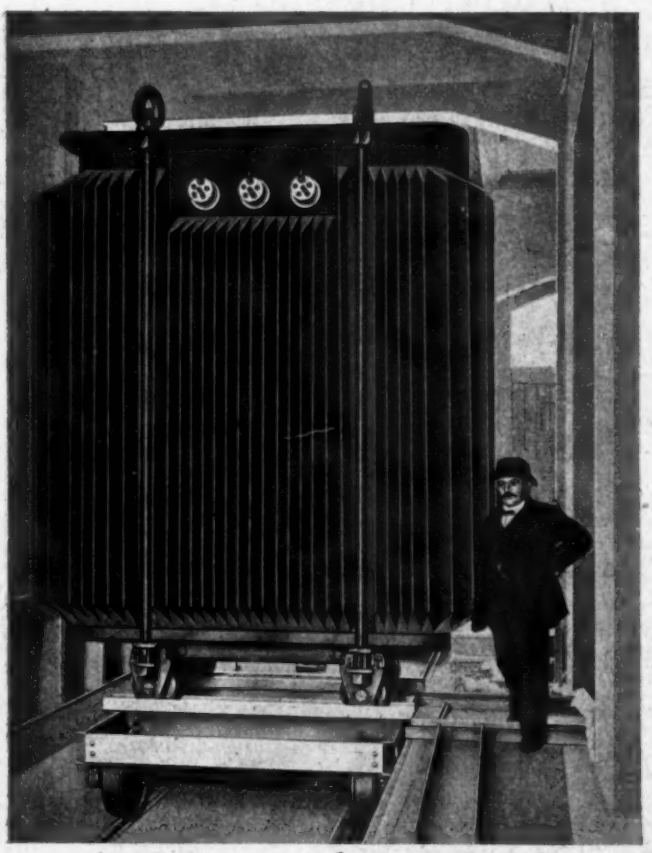
A 4000 - K.V.A. THREE-PHASE OIL-IMMERSED UNIT REMOVED FROM ITS TANK.





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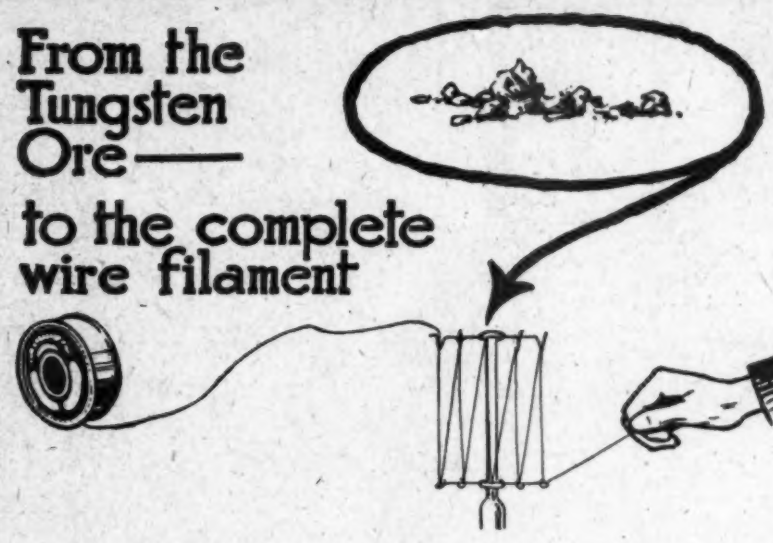

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Process by process the work is carried out by British labour in our London Works. We do not buy the Tungsten Powder or the Tungsten Rod.

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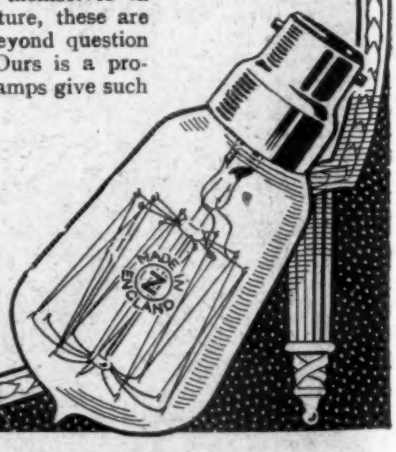

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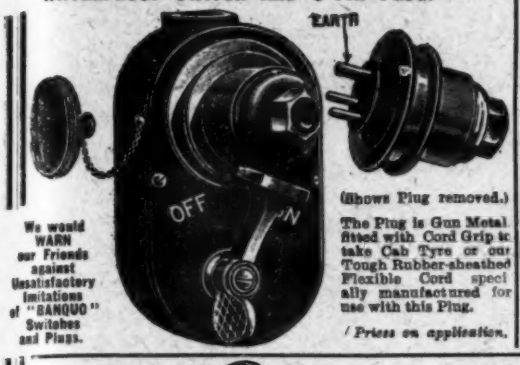
AS SUPPLIED IN LARGE NUMBERS TO ARSENALS, DOCKYARDS, EXPLOSIVES FACTORIES, CHEMICAL WORKS, FACTORIES, &c.

"BANQUO" SAFETY INTERLOCKING COMBINED WATERPROOF SWITCH AND 3-PIN PLUG.



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The Plug is Gun Metal fitted with Cord Grip to take Cab Tyre or our Tough Rubber-sheathed Flexible Cord specially manufactured for use with this Plug.

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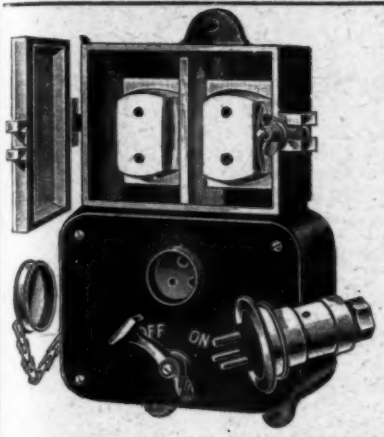

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Suitable to 250 volts.

This set comprises Double-Pole Switch which interlocks, with plug fitted with two pins and earthing pin.

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5 amps.	£2 5s.
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Made in 2 or 3-pin plug type from 10 to 200 amps. capacity.

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For use in Dye Works, Chemical Works, Steam Sheds, and exposed or corrosive positions.

Specially designed to meet the demand for an acid and damp-resisting holder.

The shell is of strong vitreous acid-resisting porcelain fitted with an acid-proof rubber shield which effectively protects the lamp cap and interior lampholder from dampness and corrosion.

The top of the porcelain holder fits on loosely after wiring, enabling the top chamber of the interior to be filled with a sealing compound. The cap is then dropped back into position, when the sealing compound is plastic.

The features of this holder are ease in wiring, reliability, and effectiveness. The holder is arranged to take Standard Tough Rubber jacketted flexible Cord. (Prices and samples on application.)

List No. 101. Price 4/- ea.

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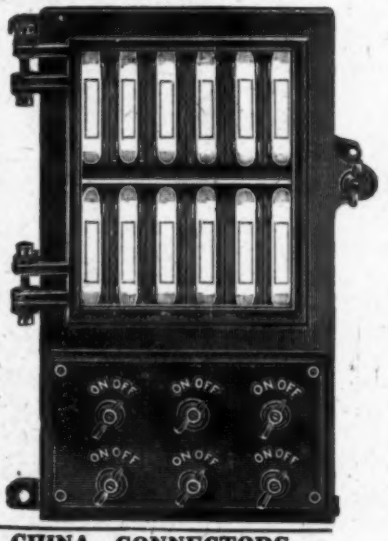
4	£1 5 6	£1 12 0
5	£1 5 0	£1 12 0
6	£1 4 0	£1 12 0
7	£1 4 0	£1 12 0
8	£1 4 0	£1 12 0



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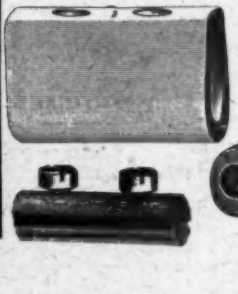
Substantial Metal Parts with good threads. No metal projecting parts.

Ensures good joints. Made in eight different sizes.



One, Two and Three-way, small size, to take up to 7/20's Cable (2·74 m/m).

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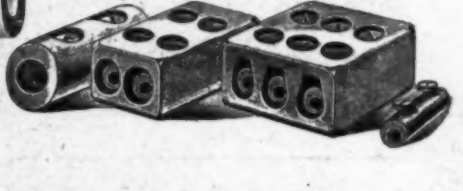

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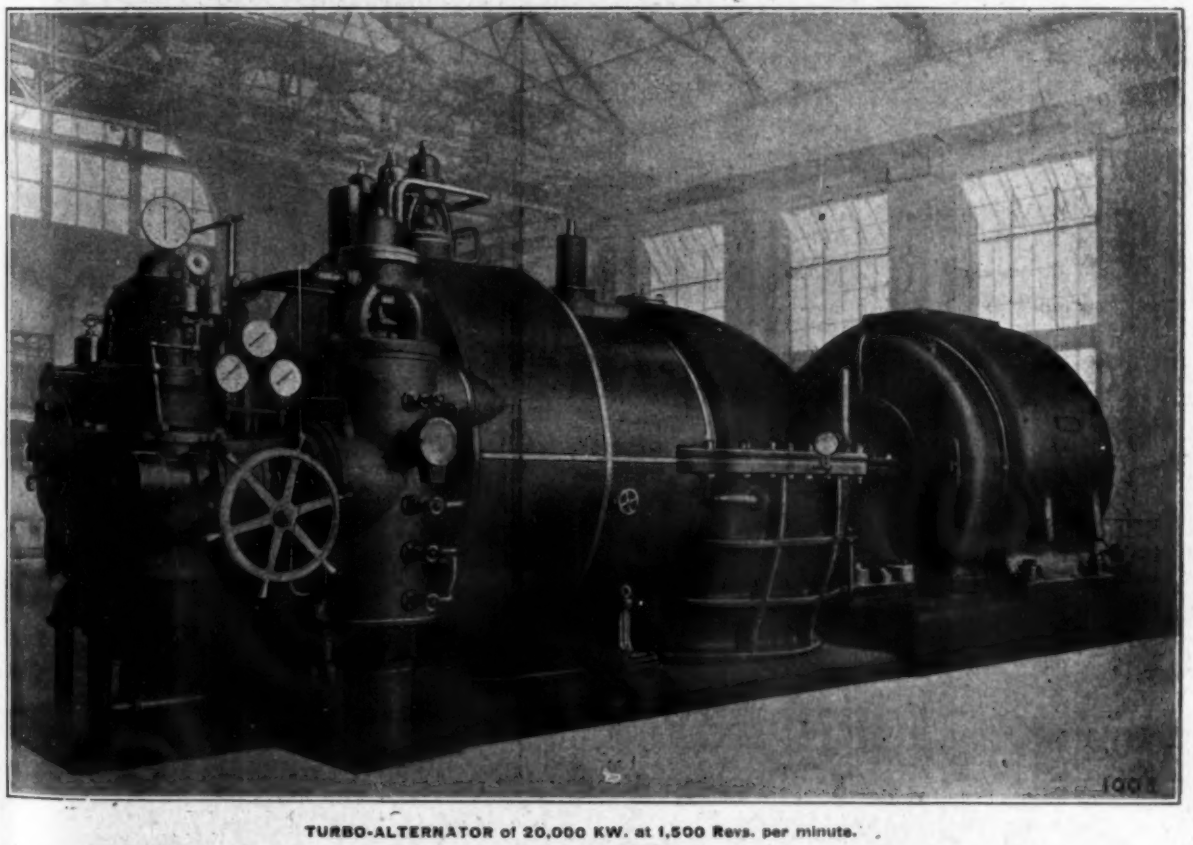

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LIGHTING AND POWER NOTES.

Bray (Co. Wicklow).—Price Increase.—The U.D.C. has increased the charges for electricity by 10 per cent.

Castlerea (Co. Roscommon).—Proposed E.I.—A new development company has been formed, with a capital of £10,000, to supply the town with electric light.

Clayton.—Prov. Order.—The L.G.B. has informed the U.D.C. and the Bradford Corporation that, until the Government has arrived at a decision with regard to the report of the Electric Supply Committee, no new prov. orders will be granted.

Continental.—Denmark.—The Copenhagen Corporation has accepted the report of its chief engineer, and voted the sum of £173,300 for increasing the output of its central station by 10,000 kw. The boilers were originally ordered in England some years ago, but as it was found impossible to obtain the necessary export certificate, a tender has been accepted from Jönköping, in Sweden, for three boilers for the sum of £87,000. A Swiss firm offered a 10,000-kw. turbo-generator for the sum of £69,000. The machinery was intended for Russia, but could not be sent there by reason of the political conditions of the country. The estimated cost of the buildings was £17,300. These prices are very high, but there is no prospect of any reduction, and the existing machinery is quite unable to meet even present requirements.—*Ingeniören.*

Norway.—The Norske A.G. for Elektrokemisk Industri, of Christiania, is increasing its capital from £800,000 to £1,600,000, with the object of opening up further mines and increasing its electricity generating stations by utilising additional water power.

Dover.—Proposed Boiler Improvements.—The T.C. has referred back to the Electricity Committee a recommendation that the boilers at the electricity works should be fitted with underfeed stokers, to enable Kent coal to be used.

East Ham.—Year's Working.—The annual accounts of the Corporation electricity department (some statistics regarding which appeared on page 420 of our issue of November 1st) show that the total cost per unit was 1·59d., against 1·29d., including fuel, ·87d. against ·72d.; wages, ·17d. against ·14d.; repairs and maintenance, ·03d., or the same as in the previous year; rates and taxes cost ·15d., against ·14d.; and management expenses ·11d., the same as in the preceding year; 3,962,904 units were sold, against 4,063,721, including private lighting, 1,502,374, against 1,554,076; public lighting, 102,570 against 100,950; traction, 2,357,960 against 2,408,695; 262,150 units were used on the works, against 249,740, and 264,326 against 204,799 were unaccounted for. The maximum load was 1,722 kw. against 1,938, and the load factor 29·9 per cent. against 26·6d. per cent. The average price obtained was 1·75d. against 1·59d.; private lighting, 2·61d. against 2·29d.; public lighting, 1·67d. against 2·16d.; tramways, 1·21d. against 1·11d.

Halifax.—Prov. Orders.—The B. of T. has informed the Corporation that it has decided not to entertain further applications for prov. orders for electricity supply until a decision has been arrived at with regard to the report of the Electric Supply Committee.

Ireland.—Water Power.—Mr. J. C. White, chairman of the Belfast Electricity Committee, has been asked by the B. of T. to become a member of the Sub-Committee for Ireland, appointed with the concurrence of the Minister of Reconstruction, to examine and report upon the water-power resources of the United Kingdom, and the extent to which they can be made available for industrial purposes. The Sub-Committee, of which Sir John P. Griffith is chairman, will deal specially with Ireland. Mr. White was associated with engineers in London as legal adviser for the Ulster Power Bill some years ago.

The Coleraine U.D.C. has applied to the Irish Society, in connection with the utilisation of water power at Cutts, Coleraine, for the generation of electricity, and the Society has promised to consider the matter.

Keighley.—Wages.—The Committee on Production has increased the war wages of charge engineers, switchboard attendants, &c., at the Corporation electricity works to 23s. 6d. per week, plus 12½ per cent. on total earnings, as from the first pay-day in October last.

Lighting Restrictions.—On Monday the Home Office issued instructions, which apply to Great Britain generally, to the effect that the shading of lights may be withdrawn, except in certain areas specified by the Admiralty, where lights are visible from the sea. Owing to the coal shortage, the prohibition of shop-window and advertisement lighting is still in force, and the total number of lamps in use for street lighting is not to exceed one-half of the normal. The use of lights in shop windows was allowed on Monday night only, as a special concession.

The B. of T. announced that the operation of Part III of the Lighting, Heating, and Power Order, 1918, relating to hotels, restaurants, clubs, and places of entertainment would be suspended during the present week.

London.—Stepney.—Year's Working.—For the year ending March 31st, 1918, the income of the B.C. electricity department amounted to £150,330, against £134,868 in the previous year, whilst the expenditure totalled £104,393, against £94,710. Debt repayments amounted to £23,527, temporary work done during the year to £409, and interest and other charges to £20,610, leaving a net profit of £3,642, compared with a debit balance of £3,584 in the previous year. Units sold numbered 24,880,717, a decrease of 2,130,813, and included—private lighting, 4,181,831, a decrease of 168,062; power and heating, 11,032,137, an increase of 158,775; public lighting, 156,856, a decrease of 22,367; bulk supplies in Stepney, 5,017,023, a decrease of 299,353; and public bulk supply, 4,492,870, a decrease of 1,799,806. The works and administrative cost per unit sold was ·993d., and the total cost 1·415d., compared with 1·232d.; the average income per unit was 1·450d. The maximum load was 11,105 kw.

Loughrea (Co. Galway).—For some nights during last week the town was practically in darkness, owing to the staff at the electric power station being laid up with influenza.

Lurgan.—Correction.—We regret that in our Lurgan note, last week, a name was spelled inaccurately. For *Mr. Sheneld* read Mr. J. Wardell Shemeld. Mr. Shemeld's relations on his father's side have been English for the past three or four hundred years.

Maidenhead.—Price Increase.—The T.C. has increased the price of electricity, as from December 31st next, by 1d. per unit for lighting and by 20 per cent. for power, a total advance on pre-war rates of 50 per cent.

Middlesbrough.—Year's Working.—At the annual meeting of the Cleveland Trust, Ltd., it was announced that the electric light undertaking showed a profit of £420.

Newport (Mon.).—Mains Extensions.—The American Red Cross Society has requested the Corporation to extend the electricity mains to the Coldra, 3½ miles from Newport, which is to be the chief American naval hospital in Europe.

Proposed Joint Supply.—The Town Councils of Derby, Nottingham, Leicester, Burton-on-Trent, and neighbouring towns have decided jointly to engage electrical engineers to report as to the best arrangement for securing the most economical supply of electricity in the district on the lines recommended by the B. of T. Committee.

Queensbury.—Electricity Supply.—The U.D.C. has granted permission to the Yorkshire Electric Power Co. for the supply of electricity to the whole of the Queensbury area.

Stirling.—Proposed Bulk Supply.—The Stirling Merchants' Association has decided to recommend the T.C. to take a supply of electricity in bulk from the Scottish Central Electric Power Co., instead of adding to its present plant.

Walsall.—Plant.—Further spare plant from the Corporation's electricity works at Wolverhampton Street has been sold for £800.

The Electricity Committee has approved of the claim of the Corporation against the Defence of the Realm Losses Commission in respect of commandeered plant.

The Committee recommends the purchase of a duplicate condenser motor for the Birchills station, at a cost of £325, a rotary converter at a cost of £3,370, and a feeder panel at a cost of £410, for the Darwell Street sub-station.

The change-over from 3,300 volts to 6,000 volts on the cable from Hospital Street to Darwell Street has been carried out.

Walkden.—Mill Driving.—Messrs. Burgess, Ledward and Co., of Wardley Mills, are about to adopt electric driving.

West Hartlepool.—Linking-up.—The Electricity Supply Sub-Committee has come to an agreement with the Cleveland and Durham County E.P. Co. upon the subject of linking-up supplies.

Proposed Loan.—The T.C. is to apply to the L.G.B. for sanction to a loan of £2,500, in connection with the extension of the supply of electricity to Irvine's Dockyard.

Price Increase.—From the December meter readings the charges for electricity to general consumers are to be increased by a further 10 per cent.

Wages.—The wages of shift engineers and station superintendents at the electricity works are to be increased by 5s. per week, and the wages of other employés by 3s. 6d. per week; in future the wages of these employés are to be automatically adjusted in accordance with the grants of the Committee on Production to the local engineering trades.

Whitwood.—Price Increase.—The Yorkshire E.P. Co. has informed the U.D.C. that the price of electricity for power will be temporarily increased from 1d. to 1¼d. per unit from November 1st last.

York.—Price Increase.—The Electricity and Tramways Committee has decided that consumers of electricity in bulk, supplied under special agreements, shall pay an increase of at least 50 per cent. over pre-war charges.

TRAMWAY AND RAILWAY NOTES.

Blackpool.—Proposed New Depôt.—In connection with the acquisition by the Corporation of the Blackpool, St. Anne's, and Lytham tramway system, the Tramways Committee has decided to acquire 4 acres of land in Rigby Road, for the purpose of a new central car depôt.

Clee Hill (Ludlow).—Proposed Light Railway.—A public meeting has decided in favour of a light railway to serve the Henley, Knowbury, Bitterley, Clee Hill, Doddington, and associated areas.

Continental.—Spain.—Application has been made for a concession for the construction and working of an electric tramway in the Province of Tarragona.

East Ham.—Year's Working.—The annual accounts of the Corporation Tramways Department show that the revenue for the year ending March 31st last amounted to £71,373, compared with £65,562 in the preceding year, and the expenditure to £67,712, against £61,069. Interest on loans amounted to £4,817; debt redemption to £5,881. Allowances to employés with the Forces amounted to £3,374, and £2,395 was transferred to the account from the borough fund, leaving a deficiency of £3,676 to be carried forward. The total cost per car-mile was 12·415d., including traffic expenses, 3·92d.; general expenses, 1·33d.; repairs and maintenance, 3·36d.; power, 2·02d.; and capital charges, 1·78d.; 1,442,436 car-miles were run, against 1,554,164, and 16,744,998 passengers were carried, against 18,618,754. The traffic revenue was 11·65d. per car-mile, against 9·91d., or an average of 1·01d. per passenger, against ·83d.; 1·7 units per car-mile were used, against 1·54.

Tramcar Lighting.—Following the Home Office instructions to the police authorities relaxing the lighting restrictions, normal interior tramcar lighting was resumed on Monday evening. The regulations as to headlights and red rear lights remain unaltered for the present.

United States.—N.Y. Subway Extension.—The New York subway extension system represents the world's greatest achievement in electric railway construction. It consists of 619 miles of track, serves four of the five boroughs of the city, and has a capacity of 3,000,000,000 passengers per annum. New York, after five years of construction work and the expenditure of $400,000,000, has completed and put in operation the greater part of her new system of rapid transit, known as the Dual System, because the Interborough Rapid Transit Co. and the Brooklyn Rapid Transit Co. have co-operated with the city in developing it. Four parallel elevated lines and a subway constituted the former rapid transit system in Manhattan. By the extensions, vast areas have now for the first time rapid transit and become easily accessible to the heart of the city. Thus the railway mileage of New York has been more than doubled, and it has the most extensive subway system in the world, comprising more than two hundred miles of underground railway. Some of the subway routes have necessitated the boring of tubes under the East river, at an enormous cost. Third tracks have been added to the elevated railways on which express service is provided during the rush hours, while instead of one subway there are now three, with express service all day. It is hoped that congestion will now be relieved, at least for a few years. A large amount of new equipment was naturally needed for the Dual System, and for this the Westinghouse Electric and Manufacturing Co. has furnished 600 control equipments and 978 motors for the Interborough lines, the total cost of this apparatus being over $3,000,000. To supplement its present power equipment the Interborough Co. has installed an 80,000-H.P. Westinghouse turbo-generator, which is the largest in the world. Further extensions are already being planned, notably a tunnel from Brooklyn to Staten Island.—*Electrical News.*

TELEGRAPH AND TELEPHONE NOTES.

Japan.—A large wireless station is to be built in Fukushima Prefecture, says the Department of Communications, and will cost 860,000 yen. The sending station will be at Hibarigahara, near Hara-Machi, and the receiving station will be at Hosoyacho. Survey work has been started by engineers of the Department. The direct distance between the new office and San Francisco is 4,600 miles, while that between the Funabashi office and Honolulu is 3,250 miles. Service will not be opened for two years. The new office will communicate direct with San Francisco without relaying in Hawaii.—*Indian Engineering.*

The Telegraph Service.—A New Federation of Postal Engineers was founded at Matlock on Saturday. The organisation demands to be treated separately in the application of the Whitley principles to Government departments.—*Daily Telegraph.*

CONTRACTS OPEN AND CLOSED.

OPEN.

Aberdeen.—November 21st. Great North of Scotland Railway Co. Six or 12 months' supply of stores, including telegraph material. Stores Superintendent, 80, Guild Street.

Bradford.—November 23rd. Tramways Committee. Stores for 12 months, including lamp fittings, insulating material, &c. General Manager.

Enniskillen.—December 1st. Sligo, Leitrim & Northern Counties Railway Co. 12 months' supply of telegraph material. Mr. J. Duff, Secretary.

London.—L.C.C. The Highways Committee recommends that tenders be invited for the supply of field coils, double cotton-covered wire, rolled-steel bars, for driving and pony-wheel axles, and insulated coils for magnetic brakes.

Manchester.—November 29th. Supply, &c., of three-phase, 6,600-volt sub-station switchgear at any sub-station in the area of supply. Specification, &c., from Mr. F. E. Hughes, Secretary, Electricity Department, Town Hall.

Newcastle-on-Tyne.—November 21st. Tyne Improvement Commission. Six months' supply of incandescent electric lamps and arc lamp carbons. Mr. J. McD. Mason, General Manager and Secretary, Bewick Street.

Spain.—January 20th. The Harbour Works Authorities (Junta de Fomento), of Melilla, are inviting tenders for the overhaul and repair, erection, and putting into operation, of an 80-ton Titan electric crane, which was sunk in the sea in March, 1914, and raised in 1916. No tender in excess of £6,400 will, it is stated, be considered.

Wakefield.—November 18th. Coal for the electricity works, Calder Vale, for year ending December 31st, 1919. Forms of tender, &c., from City Electrical Engineer, Old Town Hall.

Walsall.—December 5th. Electricity Supply Department. One 500-kw. rotary converter equipment. See "Official Notices" November 8th.

Warrington.—November 19th. Electricity & Tramways Committee. Underfeed mechanical stokers. Mr. F. V. L. Mathias, Borough Electrical and Tramways Engineer.

FORTHCOMING EVENTS.

Junior Institution of Engineers.—Friday, November 15th. At 7 p.m. At 39, Victoria Street, S.W. Annual general meeting. Paper on "Some Notes on Newspaper Printing Presses," by Mr. H. J. Coventry.

Friday, November 22nd. At 39, Victoria Street. At 7 p.m. Lectrette, "Novelties in Pumping Machinery," by Mr. H. P. Anderson.

(Midland Section).—Friday, November 22nd. At 7.45 p.m. At the Imperial Hotel, Birmingham. Paper on "The Planimeter Simply Explained without Mathematics," by Mr. W. J. Tennant.

Institution of Mechanical Engineers.—Friday, November 15th. At 6 p.m. At the Institution of Civil Engineers, Great George Street, S.W. Adjourned discussion on papers already read, and if time permits paper on "Electric Welding," by Mr. T. T. Heaton.

Electro-Harmonic Society.—Friday, November 15th. At 6.15 p.m. At the Holborn Restaurant (Venetian Chamber). Ladies' night.

North-East Coast Institution of Engineers and Shipbuilders.—Friday, November 15th. At 6.15 p.m. At Westgate Road, Newcastle-on-Tyne. Paper on "Scientific Research in Connection with Marine Engineering and Shipbuilding," by Sir Frank Heath.

Industrial Reconstruction Council.—Tuesday, November 19th. At 6 p.m. At the Institute of Journalists. Conference on "The Trade Unions of the Future," to be introduced by Mr. G. A. Isaacs.

Institution of Civil Engineers.—Tuesday, November 19th. At 5.30 p.m. At Gt. George Street, S.W. Paper on "The Tata Hydro-Electric Power Supply Works, Bombay," by Mr. R. B. Joyner.

Liverpool Engineering Society.—Wednesday, November 20th. At 8 p.m. At the Royal Institution, Colquitt Street. Paper on "Education in Relation to Industry, with Particular Reference to Engineering," by Mr. A. E. Berriman.

Royal Society of Arts.—Wednesday, November 20th. At 4.30 p.m. At the Royal Society of Arts, John Street, Adelphi, W.C. Inaugural address by Mr. A. A. C. Swinton, F.R.S., on "Science and the Future."

Belfast Association of Engineers.—Thursday, November 21st. At 7.45 p.m. At the Municipal Technical Institute. Paper on "Ljungstrom Steam Turbine and Generator," by Mr. T. H. Hurst.

Electrical Power Engineers' Association (Manchester and District Section).—Thursday, November 21st. At 7 p.m. At the Grosvenor Hotel, Deansgate, Manchester. Paper on "The Social Significance of Trade Unionism," by Mr. J. W. Thomas.

Institution of Electrical Engineers.—Thursday, November 21st. At 6 p.m. At the Institution of Civil Engineers, Great George Street, S.W. Paper on "The Use of High Pressure and High Temperature Steam in Large Power Stations," by Mr. J. H. Shaw.

Students' Section.—Friday, November 22nd. At 7 p.m. At King's College, Strand, W.C. Address on "The Permeability of Faintly-Magnetic Materials," by Prof. E. Wilson.

Physical Society of London.—Friday, November 22nd. At 5 p.m. At the Imperial College of Science, South Kensington, S.W. Ordinary Meeting.

Manchester Association of Engineers.—Saturday, November 23rd. At 6.30 p.m. At the Grand Hotel. Paper on "Conveyors in Relation to Engineering Works," by Mr. W. H. Atherton.

Birmingham and District Electric Club.—Saturday, November 23rd. At 6.30 p.m. Concert (ladies' night).

NOTES.

Electricity Supply Regulations.—The Minister of Munitions has issued the following order dated November 8th, 1918 :—

1. No person shall on or after the date hereof except under and in accordance with the terms of a permit issued under the authority of the Minister of Munitions :—

(*a*) Connect or cause to be connected to any source or means of supply of electricity any place or any building, premises or plant or any part thereof not so connected at the date hereof, or

(*b*) Supply or cause to be supplied any electricity to any place or any building, premises or plant or any part thereof not supplied with electricity at the date hereof, or

(*c*) Use or cause to be used any electricity in or at any such place, building or premises or for the purpose of any such plant as hereinbefore mentioned.

Provided that in any case coming within the scope of the Household Fuel and Lighting Order, 1918, or the Household Fuel and Lighting (Scotland) Order, 1918, as defined by Clause 1 of these Orders respectively, where the previous assent of the local fuel overseer is required and has been duly obtained to any fitting, equipment, or supply under Clause 99 of the first-mentioned Order or Clause 77 of the secondly-mentioned Order, no permit hereunder shall be required for such fitting, equipment, or supply or the use of such supply.

2. All applications with reference to this Order should be addressed to the Director of Electric Power Supply, Ministry of Munitions, 3, Northumberland Avenue, London, W.C. 2.

3. This Order may be cited as the Electricity (Restriction of New Supply) Order, 1918.

Note.—The permission required by the Order is in addition to and not in lieu of the usual priority certificates and permit reference number.

Profit Sharing.—The Labour Co-partnership Association is holding a series of five conferences and discussions during November and December at Kingsway Hall, Kingsway, to discuss certain experiments in profit-sharing and co-partnership. The first will take place on Tuesday next at 4.30 o'clock, and subsequent dates are November 20th, 26th, December 4th and 10th.

Fuel Economy.—The great munition works of Coventry and Birmingham, while their output is ever increasing, are obtaining remarkable results in fuel and light economy. Saving, to help minimise the effects of the great coal shortage, is worked on system, and much ingenuity is shown in perfecting works arrangements. The magnitude of their fuel and light requirements has startled experts. In one establishment, typical of a score, the consumption is 200,000,000 cubic feet of gas—equal to 18,000 tons of coal—per annum, and 13,000,000 units of electricity, or about four times the electricity consumption of Watford with its 50,000 inhabitants.

The means of saving successfully applied in certain Midland works are :—

A careful grading of illumination to suit various classes of work.

Abolition of local lighting for separate machines and the substitution of general lighting with suitable reflectors and larger units such as the ½-watt metal-filament lamp and mercury vapour lamps.

A systematic patrol of the works to ensure that no unnecessary lights are kept burning.

Appointment of economy engineers whose sole duty is to supervise the operation of plant to secure the most economical results.

Periodic relining of shafting to reduce power consumption.

Burning of sawdust in steam boilers. One works saves 600 tons of coal per annum by this substitution.

Keeping down the temperature of workshops. In one well-known establishment the temperature is fixed at 55 deg. F.—*Board of Trade Journal.*

Volunteer Notes.—Royal Engineers (Vols.), London Army Troops Companies.—Headquarters : Balderton Street, Oxford Street, W. 1.

Regimental Orders No. 47, by Lieut.-Colonel C. B. Clay, V.D., Commanding.
Captain of the Week.—Capt. W. Hynam.
Next for Duty.—Capt. W. D. Bentley.
Monday, November 18th, to Saturday, November 23rd.—Drills as usual.
Sunday, November 24th.—Commandant's Parade at Waterloo Station, 9 a.m., for Inspection at Esher. Drill order. Mid-day and tea rations to be carried.

C. Higgins, *Capt.* R.E., *Adjutant.*

Trouble at Johannesburg.—Municipal engineers of Johannesburg are again causing trouble by refusing to handle brake blocks procured from Cape Town.—*The Times.*

The Electro-Harmonic Society.—At the concert (ladies' night) to be held this evening at the Holborn Restaurant, commencing at 6.15 p.m., Mr. Gerald W. Partridge will be in the chair. Artistes : Miss Ada Forrest, soprano ; Miss Dorothy George, contralto ; Sapper Frank Webster, R.E., tenor ; Sapper Joseph Farrington, R.E., baritone ; Mr. F. Weist Hill, violinist ; Mr. Walter Churcher, humorist ; Mr. Maurice Charles, humorous cartoonist ; Mr. Bernard Flanders, A.R.A.M., pianoforte solo and accompanist.

Appointment Vacant.—Meter tester and repairer for the Burton-on-Trent Corporation electricity department. See "Official Notices" to-day.

Electrical Trade Supplies.—The following letter has reached us just as we go to press :—

"May I ask the hospitality of your columns to draw your attention to a matter of the most urgent importance ?

"Raw materials are in future to be apportioned to individual firms, not by Government Departments, but by Industrial Councils which are being set up to represent all the various trades, and these will be dependent on a Central Priority Council for their supplies.

"I understand that the engineering trade, for some reasons best known to themselves, have rejected the proposal of these Councils, and apparently intend to base their hopes on obtaining supplies on their various Employers' Federations.

"What is the electrical trade doing ? Is it following the example of the engineering trade, or is it setting up its own Industrial Council ?

"No one seems to know. I have made a number of inquiries, but everyone seems to be in the dark as to what is being done.

"I suggest that if such an Industrial Council is being formed by the electrical trade, a little information might be given in your columns by the secretary. If no such Council is contemplated at present, then I suggest that all firms interested should take immediate steps for its formation.

"Napier-Kimber, Ltd.
"A. W. Kimber, *Managing Director.*
"London, W. 1, *November 13th*, 1918."

Fire Warning.—The British Fire Prevention Committee has issued a timely warning against fire risks at celebrations and entertainments, of which copies can be had on written application to the Committee (8, Waterloo Place, S.W. 1), enclosing return postage.

Institution and Lecture Notes.—Institution of Electrical Engineers.—At the opening meeting of the session, last week, the president (Mr. C. H. Wordingham) moved a vote of condolence with the relatives of the late Prof. Bertram Hopkinson, Mr. J. O. Callender, and Mr. E. Russell Clarke ; he also proposed that the Institution should establish a memorial to those who had fallen in the war. He announced the formation of a "Foreign Relations Committee" to facilitate the interchange of experience between British and foreign engineers, and the harmonising of their technical regulations—the latter function being already exemplified in connection with ship work. Premiums were then awarded to those who had read papers before the Institution during the past session, after which Mr. Ll. B. Atkinson read the Kelvin Lecture. At the close of the meeting some 40 members dined together informally at the Waterloo Restaurant.

Electrical Power Engineers' Association (Midland Division).—A general meeting of this Division was held at the Chamber of Commerce, Birmingham, on November 9th, when a large and representative gathering gave the president a hearty welcome on the occasion of his first meeting in Birmingham. Mr. Lunn, in the course of his address, reviewed the progress of the E.P.E.A. from its inception to the present time, and indicated the probable course of action of the executive in the future, his statements regarding the policy of the Association being unanimously endorsed by the meeting.

Southern Division.—At a recent meeting of the Divisional Executive Council of this Division, the following officers were elected for the ensuing year :—

Chairman, G. D. Bendix.
Hon. Secretary, A. C. Bostel, 3, Park Lane, Croydon.
Hon. Treasurer, W. L. Leece.
Hon. Publicity Secretary, T. W. Smith.

Inquiries relating to divisional matters should be addressed to the Hon. Secretary, as above.

Information *re* membership, &c., may be obtained from the Section Hon. Secretaries as under :—

London Western Section	...	W. J. Wilcocks, 8, Willow Avenue, Barnes, S.W. 13.
London Central Section	...	E. N. Christmas, 55, Calabria Road, N. 5.
London Eastern Section	...	W. Sawford, 74, St. Mary's Road, E. 10.
London South-Eastern Section	...	E. W. Martin, 169, Well Hall Road, S.E. 9.
South Coast Section	... ...	W. J. Gibbons, 8, St. Andrew's Road, Portslade, Brighton.
Portsmouth Section	... ...	P. L. Weir (*pro tem.*), 112, Laburnum Grove, North End, Portsmouth.
Bristol Section	... ...	F. J. Elliott, 8, Glena Avenue, Knowle, Bristol.

Junior Institution of Engineers (N.E. Section).—The syllabus of meetings for the new session, which opened on October 15th with a general discussion on the Coal Conservation Committee's Report, followed on October 29th with "Coal and Ash Handling Plants," by N. Thornton, contains the following :—

November 12th.—"Design of High-Speed Steam Turbines," by M. Ward.
November 26th.—"Boilers, Coal and Gas Fired," by Messrs. E. F. Oakford and S. H. Moore.
December 10th.—"Pumps, Condenser Systems, &c.," by Messrs. T. W. Stewart and H. J. Aldis.
January 7th, 1919.—"Design of High-Speed Generating U ," by G. Bonner.
January 21st.—"Design of Heavy Switchgear," by F. A. ard.
February 4th.—"The Construction of Large Transform

February 18th.—"H.T. Transmission Lines, Overhead and Underground," by G. S. Lisle.
March 4th.—"Electrical Disturbances in Supply Systems," by L. C. Grant.
March 18th.—Subject to be announced later, by E. F. Oakford.
April 1st.—"General Electrical Indicating Instruments." by S. Evans.
April 15th.—"The Manufacture, Testing and Use of Portland Cement," by A. Stewart-Davies.
April 29th.—"A.C. Diagrams and their Systematic Development," by M. M. Hall.
May 6th.—"Design of Marine Turbines," by M. Ward.

Royal Society.—The following have been recommended by the President and Council for election on the Council for the ensuing year at the anniversary meeting on November 30th :—

President.—Sir Joseph J. Thomson.
Treasurer.—Sir Alfred Kempe.
Secretaries.—Prof. Arthur Schuster and Mr. William Bate Hardy.
Foreign Secretary.—Prof. William Herdman.

Other Members of the Council :—Sir George Beilby, Prof. Vernon Blackman, Mr. Charles V. Boys, Sir James Dobbie, Sir Frank Dyson, Dr. Martin Forster, Prof. Frederick Gamble, Dr. James W. L. Glaisher, Sir Richard Glazebrook, Sir Alfred Hall, Sir William Leishman, Prof. William J. Pope, Dr. W. H. R. Rivers, Prof. Ernest Starling, Mr. James Swinburne, and Prof. William W. Watts.

Royal Society of Arts.—The opening meeting will be held at 4.30 p.m. on Wednesday, November 20th, when an address on "Science and the Future" is to be delivered by the Chairman of the Council, Mr. Alan A. Campbell Swinton, F.R.S.

There is a long general provisional list of papers for next year on scientific and economic subjects by eminent authorities. The first series of three Cantor Lectures will be given by Dr. James C. Philip, Professor of Physical Chemistry, Imperial College of Science and Technology, on "Physical Chemistry and its Bearing on the Chemical and Allied Industries" ; by Dr. J. A. Fleming, Professor of Electrical Engineering, University College, on "Scientific Problems of Electric Wave Telegraphy" ; and by Prof. W. A. Bone, of the Imperial College of Science and Technology, on "Fuel Economy." The Juvenile Lectures are to deal with "Liquid Drops and Globules," the lecturer being Mr. Charles R. Darling, Lecturer in Physics at the City and Guilds Technical College, Finsbury.

Electrical Association of Australia.—In the course of an address to the N.S.W. Section, Mr. O. W. Brain, Government electrical engineer, stated that all the electricity consumed in the railway and tramway workshops and the numerous auxiliary services of the department throughout the metropolis came from the White Bay power house at Balmain.

The site at White Bay, he said, was an excellent one, especially in view of the proposed electric railways. The available area was sufficient for a plant having an output of over 100,000 KW. There was unlimited circulating water available from White Bay, and the site was fairly centrally situated in relation to the existing electric system and to the future suburban railway service. The requirements of railway traction might be expected to reach something of the order of 100,000 KW, within a measurable period after commencing operations.

The completion of the White Bay power house had progressed quite slowly for some time past, and it was not until May, 1918, that a full working equipment for ordinary operation was available. The following were the figures of the actual service for last May : Output in KW.-hours, 4,982,828 ; maximum load, 16,320 KW. ; load factor, 42·3 per cent. ; pounds of coal per KW.-hour, 1,934 ; pounds of steam per KW.-hour (used by turbines), 13·93.

For some time the department had been furnishing a supply to the Sydney City Council every evening, and provision had been made for an interchange of up to 6,000 KW. The Railway Commissioners would supply the Newcastle City Council with electricity in bulk, to meet the requirements of the whole district, from the Zarra Street power house, which had been designed for an output of 50,000 H.P. Already three important new industries were arranging to start under these conditions.

ELECTRIC STEEL FURNACES.—At Dudley, on Saturday, before the members of the STAFFORDSHIRE IRON AND STEEL INSTITUTE, Mr. F. J. Moffett read a paper on "Recent Developments of the Electrical Steel Furnace." In many parts of the United Kingdom the price per unit, he said, was now at such a level as to enable steel makers to employ the electric furnace for many purposes with commercial success. The cost of electrical energy was the most important consideration in the operation of an electric furnace. When it was possible to use blast furnace or coke oven gases for the generation of electricity, the cost could be brought very low. With the urgent need for economy in the use of fuel, and the demand for the by-products derived from coal, it was probable that in the period following the war very much more attention would be devoted to this method of power production. The supply of electricity to an electric furnace or furnaces could always be given at a lower rate than for the most other purposes, owing to the good load factor. They were, therefore, justified in looking forward to the possibility of obtaining in the near future electric energy for furnace work at a cost of something like 2d. per unit.

ELECTRIC WELDING OF SHIPS.—At a meeting of the Lancashire Branch of the BRITISH FOUNDRYMEN'S ASSOCIATION, held on Nov. 2nd at Manchester, a paper was read by Engineer Lieut.-Commander L. Jackson, R.N., upon "Welding," in which he described more particularly the method followed in effecting repairs upon the German ships which were taken over by the American Government.* In summing up, particular attention was drawn to the following points :—In welding cast-iron it was particularly essential that the welding material be held on the cast-iron surfaces with the greatest care, since it was the juncture between the cast-iron and the welding metal which was liable to be inferior. To accomplish this the welding metal should be laid over the cast-iron surfaces wherever possible before the patches were put in place. This method gave the welder more room to work, and permitted him to keep a steadier arc, and this reduced the probability of too much or too little heat spoiling that part of the weld. This metal as it was laid on the cast-iron surface should then be preened by a caulking tool, in order to develop any hard spot or spots where contact was not good. After this part of the operation was completed, the patches should be put in place and the completion of the weld then was merely welding of steel to steel, which was a very simple process.

Mr. Peakman, discussing the paper, said he had been interested in all types of welding for seven or eight years. All the people supplying apparatus for welding would say that they had never known a welded piece of steel to break at the weld—it was always away from the weld. Dr. Rosenhain, of the National Physical Laboratory, as well as others, was led to make inquiries why that phenomenon existed, and it was discovered that there was a boiling up of pearlite at the zone which had been produced during the welding at 600° C. It could be marked out as the spot where the weld would break unless annealed. Therefore, his advice to foundrymen was : "Do not weld if you can possibly avoid it. If you do weld, anneal afterwards."

Mr. W. S. Abell, chief ship surveyor of Lloyd's Register, read a paper upon "Electric Welding for Shipbuilding Purposes," under the auspices of the NORTH-EAST COAST INSTITUTION OF ENGINEERS AND SHIPBUILDERS, at Newcastle-upon-Tyne, on November 8th. Mr. Abell said that the question of the application of electric welding to ship construction had come very much into prominence during the past year, and the Committee of Lloyd's Register last winter conducted a series of experiments to determine the suitability of the process and the methods of its application. The lecturer dealt with the results of the experiments, and emphasised the importance of the tests to determine the ability of welded joints to stand the alternating stresses to which ships at sea were subjected. The opinion was expressed that electric welding was suitable for smaller-sized vessels, and if the result of its application to these craft proved satisfactory, he thought there was no question but that they would be justified in extending the use of the method to larger vessels. Prof. G. Stoney said electric welding marked a most important advance in structural work. It would be a great thing if they could get rid of riveted joints, and make a ship one homogeneous whole. He mentioned that a German aeroplane had been built up of steel tubes welded together, and if that could be done, why not a ship ?

Bristol Technical Staff Engineers.—In our advertisement pages to-day is a notice of a mass meeting of Technical Staff Engineers to be held at the Grand Hotel, Bristol, to-day week, November 22nd.

The Nobel Prize.—The *Times* Stockholm correspondent says that the Nobel prize for physics for 1917 has been awarded to Prof. C. G. Barkla, of Edinburgh, for his discovery of characteristic Röntgen rays in elements.

Educational.—MANCHESTER MUNICIPAL COLLEGE OF TECHNOLOGY.—A report just issued for the years 1913-18 states that important researches have been undertaken for Government Departments. Although the war has drawn away from the College over two-thirds of its students, there are to-day actually more undergraduates than there were in 1911-12. At that time only 30 per cent. of those entering for the full course had matriculated. Now the proportion has reached 75 per cent. Seventy-five members of the College have laid down their lives for their country during the war, and many distinctions have been won by students. The delay in expanding the College buildings has made the need for extensions more than ever apparent.

£10,000 FOR SWANSEA TECHNICAL COLLEGE.—At a meeting of Swansea Town Council, recently, a gift of £10,000 from Mr. W. T. Farr, of Mumbles, formerly managing director of the Graigola-Merthyr Colliery Co., Swansea, for the endowment fund of Swansea Technical College was announced. Over half of the £150,000 appealed for has been promised.

A Channel Tunnel for Japan.—Permission has been applied for to construct a tunnel under the Shimonoseki Straits, connecting Kyushu with the mainland. The length of the tunnel would be about six miles.

Synthetic Coal.—As intimated in a previous note, Mr. Samuel C. Davidson, chairman and founder of the Sirocco Works, Belfast, has solved the difficult problem of making synthetic coal out of crude peat. The immediate difficulty was to get rid of the 60-80 per cent. of moisture in the raw material in winter weather, air drying being the usual mode in summer months. Mr. Davidson's process is very simple; he gave a demonstration of it a few days ago to his Excellency the Lord Lieutenant of Ireland (Lord French). The raw peat is macerated in a mortar mill, and lime and bitumen in certain proportions are added to the pulp. The latter is allowed to stand for a few hours, and is then put under hydraulic pressure, which drives out the 60-80 per cent. of water, leaving a "briquette" of a given shape or size, which burns well within a few hours of manufacture. Thus within forty-eight hours the raw peat can be converted into fuel. Mr. Davidson is erecting a demonstration plant on a larger scale at his Belfast works. It may be of interest to add that Mr. Davidson secured a clue towards the coagulation of peat whilst interested in the rubber industry of Ceylon. The residue of peat fuel thus manufactured is almost pure potash.

* ELECTRICAL REVIEW, April 5th, 1918.

The Coal Shortage in Ireland.—A correspondent who has just returned from a business tour in Ireland informs us that in that fortunate country one hardly knows there is a war on, except for the shortage of coal. Practically all industrial coal is imported from England or Scotland, so that the present lack of tonnage accentuates the difficulties which we ourselves are experiencing, and a high rate for freight has to be added to the pit-head cost.

Under the circumstances, one would expect all coal importers and large users to check very carefully the weight of the coal which they purchase, but as a matter of fact very few do so. The Dock Authorities in Dublin and Belfast provide the cranes for unloading the steamers, but no facilities exist for weighing the cargoes.

Occasionally a merchant is able to pass a complete shipload over a weighbridge, but more often than not the cargo is discharged in different directions, so that a proper check is impossible. When a complete shipload *is* weighed, it frequently turns out below the advised figure. Naturally, the coal merchant does not intend to suffer if he can help it, and he is generally able to "pass on" any shortage to the user, who is without proper weighing machinery, and in consequence must pay for the weight advised; this is particularly easy when the coal is delivered by barge, and the rough-and-ready method of computing the weight of the cargo by the displacement of the boat is considered sufficient.

With the present dearth of weighing facilities at the docks, it behoves all large users of coal in Ireland to make certain that they actually receive the weight which they are supposed to do, and we are glad to learn that the Belfast Electricity Department, under Mr. T. W. Bloxam, leads the way in this respect. Coal is brought in barges to the Albert Bridge generating station, and unloaded by means of a crane and grab; the grab empties into an automatic scale, which weighs and totalises every pound of coal before passing it into the bunkers. By this means Mr. Bloxam knows the exact weight of coal brought by every barge. The neighbouring gas department—also a Municipal enterprise—is not so happily situated, and in consequence has to accept the merchants' weights.

The electricity department is also to the fore at Londonderry, where Mr. R. V. Macrory has recently installed a modern coal-handling plant fitted with an automatic scale similar to the one at Belfast; this machine has already been the means of a considerable economy.

At Dublin, the electricity supply for the tramways is provided by the Dublin United Tramways Co., and for lighting and power by the Corporation; we understand that the engineers of both undertakings are fully alive to the necessity of weighing their coal, and are considering the adoption of more up-to-date machinery for that purpose than they possess at present. The same remark applies to the Cork electricity department, under Mr. Nalder.

Money and Industry.—In a speech on the Supplementary Vote of Credit in the House of Commons on Tuesday, Mr. McKenna said (according to the *Times* report) that there was an urgent need now of ending all unnecessary expenditure; that was actually vital; and unless we proceeded to reconstruct at once we should fail in the competition with our foreign competitors, for we could not forget the fact that large masses of our foreign trade at the present time were lost to us. We had to recover these, and we could only do so by a rapid development of our manufacturing export power. It was of very great importance that there should not be any carrying on at reduced speed in the construction of unnecessary articles and that we should devote the whole of our capital expenditure and labour at once to the production of essential articles. There would be plenty of work, and high wages. Prices were high and would probably remain high, and consequently profits would be high. In fact there was no reason to anticipate that under skilful and prompt action the trade and industry of this country would not rapidly recover. But they must not be hindered by the continuance of governmental activities now when we had at length secured peace.

Proposed Tunnel to Ireland.—The first report of the Select Committee on Transport was published on Saturday. A sub-committee which visited Ireland obtained evidence in relation to the possibility of improving the transport connections between Great Britain and Ireland by means of a tunnel or of train ferries, but the Select Committee is not yet in a position to express any opinion or to make recommendations.

The Decimal Association.—The annual general meeting was held on Thursday last week at the Manchester Hotel, by kind permission of the British Electrical Federation. In the unavoidable absence of the president, Lord Belhaven and Stenton, the chair was taken by Mr. T. McKenna, chairman of the Executive Committee. The chairman referred in his speech to the progress which had been made during the past year, which had resulted in the introduction into the House of Lords of a Decimal Coinage Bill; the subject was now being considered by a Royal Commission, of which he was a member. He also alluded to the recent considerable increase in membership and revenue, and gave as further evidence of progress the issue of a quarterly journal, the first number of which was quickly sold out.

The report was unanimously approved, and fresh rules for the Association and its branches were adopted. The past members of the executive were re-elected, and the committee was further strengthened by the election of Mr. E. M. Rodocanachi, Mr. David Scott, and Mr. C. Turnbull.

Electrified Wheat.—On page 112 of our issue of August 2nd we referred to the process of electrifying seeds invented by Mr. Fry, of Godmanstone, Dorchester. We now learn from the *Daily Chronicle* that after careful examination by representatives of the Governments of France, the United States, Japan, and other countries, the process has been recommended for immediate trial. It is estimated that if the process were adopted universally throughout these islands the yield of grain would be increased by a million and a half tons.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the* ELECTRICAL REVIEW *posted as to their movements.

Central Station Officials.—The Gillingham T.C. has increased the salary of the borough electrical engineer by £100 per annum, making a total of £400 per annum, including war bonus.

Poplar B.C. Electricity Committee recommends that Mr. H. W. UNDERHILL, station electrician, be placed in Grade V of the Council's scale as from January 1st, 1918, at a salary of £162 10s. per annum, rising to £185; and that Mr. L. C. TEMPLEMAN be appointed charge engineer as from August 1st last at a salary of £150 per annum, rising to £185.

Mr. H. PARSONS has resigned from the L.C.C. Stores and Contracts Committee. Lieut.-Col. E. W. MORRISON BELL has been appointed in his stead.

Mr. R. H. WILKINSON, tramways manager, Huddersfield, has been presented by members of the staff with a smoking cabinet on his departure for Bradford.

Mr. J. TOWNLEY, works superintendent at the Hylton Road electricity works of the Sunderland Corporation, has been appointed, and has now taken up his duties, as acting borough electrical engineer to the Barnsley Corporation electricity department.

The resignation of Mr. E. M. HOLLINGSWORTH, electrical engineer at St. Helens, who has accepted a position with the United Alkali Co., Ltd., takes effect on January 16th next. The Electricity Committee has placed on record its appreciation of his services and regret at his resignation. Mr. J. W. WARR, assistant electrical engineer, has also resigned to take up another appointment.

General.—The King has awarded the Edward Medal to JOHN GARNER, a stoker at the B.T.H. factory at Rugby, under the following circumstances:—

On April 29th, 1918, one of a battery of seven boilers in the boiler-house of the factory of the British Thomson-Houston Co., Ltd., at Rugby, exploded. Garner, a stoker, at once entered the house, which was filled with steam and boiling water, and in a serious condition, in the hope of rescuing any person who might be injured. Large masses of masonry were threatening to fall, and either of the remaining two boilers under steam was likely to explode at any time. The only light available was a hand lamp carried by Garner. After searching some five minutes, Garner discovered an injured man lodged on a projecting beam; but was unable to reach him. He stood by him, however, until the beam canted and the injured man fell to the ground without further hurt. No other persons were injured by the accident. Garner undoubtedly risked his life to save a fellow-workman.

Mr. H. B. RENWICK, of the County of London Electric Supply Co., Ltd., who has held the position of Director of Feeding Stuffs under the Ministry of Food since September, 1917, has found it necessary to resign in consequence of the urgent demands on his time in connection with the electric supply problems of the country.

Mr. J. C. WHITE, chairman of the Belfast Corporation Electricity Committee, who has been appointed a member of the Irish Sub-Committee on Water Power Resources (of which Sir John P. Griffith, Dublin, is chairman), acted some years ago as legal adviser in the promotion of the Ulster Power Bill, when the water power of Ulster for electricity and other purposes was the subject of considerable research.

Mr. F. L. WRIGHT, late of Queads, Ltd., and Messrs. Tyler and Freeman, has been appointed a Director of Messrs. Napier-Kimber, Ltd.

Roll of Honour.—Lieutenant J. GRAY, R.W. Surrey Regiment, son of Mr. James Gray, managing director of the Electric Construction Co., Ltd., has been awarded the Military Cross. The award, which follows the gaining of the Croix de Guerre some time ago, is made because "he repeatedly distinguished himself in action, especially when he led his company, with a total disregard for personal safety, under intense and accurate machine-gun fire. He inspired his men with great confidence, and successfully dealt with some difficult situations."

Sapper A. J. RANDALL, employed in the Poplar B.C. electricity department, who was awarded the Military Medal two years ago for conspicuous bravery in laying and repairing telephone cables under heavy shell and rifle fire, has again received commendation from the Major-General Commanding

his division for distinguished services in the field in October last.

Company-Sergeant-Major E. J. Nunn, partner in Messrs. Bowden & Higlett, electrical engineers, of Guildford, has died at Bangalore, India, from influenza. He was an old Volunteer, and signing on for further service when he became time-expired, two years ago, he was drafted to India in October, 1916.

Private J. Ellis, Essex Regiment, who has died from influenza, was for nearly 20 years with Messrs. Crompton and Co., Ltd., Chelmsford.

Air-Mechanic E. Loveridge, R.A.F., who has died at Blandford from pneumonia, following influenza, was the son of Mr. Loveridge, electrician, of Southport. He enlisted from the business only three weeks ago. Sergeant F. Loveridge, King's Liverpool Regiment, another son of Mr. Loveridge, fell in action in May, 1915.

Company-Sergt.-Major W. Hedges, Lancashire Fusiliers, who enlisted from the Salford Corporation tramway staff, has been awarded the D.C.M. for great courage and determination under fire.

Second Lieutenant J. S. Youll, V.C., Northumberland Fusiliers, who was killed in action on October 27th, in his 22nd year, began work when he was about 15 years old as an apprentice electrician at Thornley Colliery, and on reaching military age he joined the Forces.

Private W. Walker, Worcestershire Regiment, who has fallen in action, was in the Sheffield Corporation electricity department.

Private R. Smith, who has been killed in action in France, was on his enlistment a member of the Carlisle Corporation electricity works staff.

Signaller H. Biggins, Manchester Regiment, wounded for the third time, was employed by Messrs. Ferranti, Ltd., Hollinwood.

Private S. T. Shuter, Manchester Regiment, killed, was 19 years of age, and a former employé of Messrs. Ferranti, Ltd.

Gunner H. N. Brennand, R.F.A., awarded the Military Medal for gallantry in battle, was employed at the Blackburn Corporation electricity works.

Private J. Lathrope, Royal Welsh Fusiliers, killed in action, was employed by Messrs. Charles Macintosh & Co., Ltd., Manchester.

Private J. Land, Manchester Regiment, who has died of pneumonia, was formerly employed at the British Westinghouse Co., Ltd., Trafford Park.

The death is reported in action of Private T. Kelly, Argyle and Sutherland Highlanders, who was employed at Burnley Corporation electricity works.

Private C. Stainthorpe, Duke of Wellington's Regiment, who has died of wounds, was employed at the Valley Road electricity works, Bradford.

Private S. J. F. Powers, who has died in Paris after an attack of Spanish influenza, was employed by Messrs. Ingleby and Sons, engineers, Hunslet, Leeds. He became an electrician in the 14th Divisional Supply Column, M.T., A.S.C.

Alderman J. H. Palin, secretary of the Tramway and Vehicle Workers' Union at Bradford, who is at present a sergeant in the Labour Corps on war transport service abroad, has been definitely accepted as the Labour candidate for the North Division of Bradford.

Signaller J. Waller, South Lancashire Regiment, who has been wounded, was employed by Mr. Harry Bibby, electrician, Warrington.

Private C. Heywood, King's Shropshire Light Infantry, who has died of wounds, was employed by the British Westinghouse Co., Ltd., Trafford Park.

Lance-Corporal J. F. Powell, Manchester Regiment, who has died of wounds, was employed by Messrs. Veritys, Ltd., Manchester.

Private A. Wynn, Lancashire Fusiliers, killed in action, aged 32, was employed at the Rochdale Corporation electricity works.

There passed away on November 6th, at Newcastle-on-Tyne, of pneumonia following influenza, Lieutenant V. O. Davis, R.E. (S.R.), M.I.E.E. and A.M.I.C.E., A.C.G.I., manager of the Newcastle-on-Tyne branch of the British Thomson-Houston Co., Ltd., aged 33.

The *Times* "Deaths" column announces that Mr. F. N. Tallant, aged 23 years, was lost on October 4th on the torpedoed liner *Hiramo Maru*, whilst proceeding on service to Cape Town for the Eastern Telegraph Co.

Private W. Walker, employed at the Sheffield Corporation electricity works, was killed in action on October 14th.

Gunner T. G. Harris, formerly employed at the power station at Aston, near Birmingham, has been killed in action.

In these hours of victory and rejoicing, our readers, we are sure, will desire to join with us in tendering sympathy to Mr. and Mrs. A. P. Wood, on the loss of their eldest son, Second Lieutenant G. K. P. Wood, Lancashire Fusiliers. Mr. Wood is the managing director of the Lancashire Dynamo and Motor Co., Ltd., Trafford Park, Manchester, and the Lancashire Ordnance & Accessories Co., Heaton Norris, and a member of the Council of the British Electrical and Allied Manufacturers' Association. Second Lieutenant Wood, who was born in 1899, was educated at Bowdon College and Malvern College, and entered Sandhurst twelve months ago, passing out in August last. He had been in France only a few days, and met his death leading his platoon "over the top" at dawn on November 1st. His commanding officer wrote of him as being a most promising officer, possessed of great personal bravery.

Obituary.—Lieut. Wm. Llewellyn Preece.—We deeply regret to record the death, which occurred on November 10th, at the age of 52 years, at 42, Cheyne Court, London, from pneumonia following influenza, of William Llewellyn Preece, Lieutenant, R.N.V.R., M.Inst.C.E., &c., eldest son of the late Sir William Preece. Lieutenant Preece had been for some years in indifferent health, and there is little doubt that the strain of his work at the Admiralty and at Queen Anne's Gate, the offices of his firm, proved beyond his strength. He was born at Southampton in 1866, and after early education at private schools, he went to King's College School in 1882. He spent two years there, and then went to Germany for a year. In 1885 he studied at the Electrical College, Hanover Square, and in 1886 he joined the staff of the telegraph department of the Midland Railway under the late W. E. Langdon. He was appointed chief assistant to Mr. Langdon in 1892. In 1898 he resigned from the Midland Railway, and joined Sir William Preece, Major Cardew, and his brother, Mr. A. H. Preece, and became a partner in Preece & Cardew, consulting engineers. Subsequently, in 1909, Sir John Snell joined the firm, and in 1915 Mr. John H. Rider, the firm becoming Preece, Cardew, Snell & Rider. Mr. W. Llewellyn Preece devoted most of his time as a member of the firm to telegraph, telephone, and wireless telegraph matters. This included telegraphs and telephones and wireless telegraphy in all the principal colonies, both under the Crown Agents and the High Commissioners for South Africa and New Zealand. He was responsible for various wireless telegraph stations chiefly for the Colonial Office at Aden, Fiji, Ceylon, Solomon Islands, and, conjointly with Captain Brunot of the French Government, for the New Hebrides. In 1912 he undertook a special investigation for the Federated Malay States Government of the telephone and telegraph system in that colony. He also visited Trinidad and other colonies to report on similar questions. He gave evidence for the Post Office before the Parliamentary Committee upon the Marconi Contracts.

In 1917 he received a commission in the Navy as Lieutenant in the R.N.V.R., and his principal work has been in connection with scientific devices for detecting the presence of submarines. Mr. Preece read a paper in 1915 before the Institution of Electrical Engineers upon "Telephone Troubles in the Tropics." In 1914 he entirely revised the well-known text-book on "Telegraphy," written by Sir William Preece and Sir J. Sivewright. He has recently been engaged in preparing a biography of Sir William Preece. Mr. Preece was elected an Associate Member of the Institution of Civil Engineers in 1897, and a full member in 1907. He was also elected an Associate Member of the Institution of Electrical Engineers in 1887 and a full member in 1897. He was a member of the Council up to his death. He was also a member of many other scientific institutions. In addition to his electrical engineering work, Mr. Preece was keenly interested in Church matters, and wrote many papers on religious subjects. He was acting as a secretary of a branch of the Churchman's Union. He leaves a widow, three sons and four daughters.

The funeral took place at Carnarvon yesterday, and there was also a memorial service at Christ Church, Victoria Street, S.W., at midday.

Mr. Cecil Taylor.—We regret to record the death, which occurred on November 4th, from pneumonia, of Mr. Cecil Taylor, the younger son of Mr. F. W. Taylor, electrical engineer, Milnsbridge, Huddersfield. Deceased was 24 years of age, and was works manager for his father.

Mr. M. W. O'Connell.—We regret to learn of the death of Mr. M. W. O'Connell, director and secretary of Pope's Electric Lamp Co., Ltd., Willesden, who passed away in his 48th year last Friday morning from pneumonia, after a short illness. Mr. O'Connell had been connected with the electric lamp industry for the last 35 years, having had a wide and varied experience, not only in this country, but in France, Holland, and Germany. His loss will be felt both by the industry and by many with whom he came into contact and who looked upon him as a personal friend.

Mr. J. P. Stockbridge.—The death has occurred of Mr. J. P. Stockbridge, well known in Northern electrical engineering circles. He was born at Cambridge in 1883, and served his apprenticeship at the works of the Cambridge Electric Supply Co., Ltd., transferring in 1901 to Messrs. C. A. Parsons & Co., Ltd., Heaton Works, Newcastle-on-Tyne. He continued in service there until 1910, when he was sent by the firm to Australia to supervise the complete electric power-station equipment of the Adelaide Tramways Commission, for which Messrs. Parsons were the principal contractors. Returning to England in 1912 he was entrusted with the management of the Close Works at Gateshead, and continued in that capacity after they were acquired, in 1915, by Sir W. G. Armstrong, Whitworth & Co., Ltd.

Lieut. T. N. Browett.—We regret to read in the *Times* of the death, which occurred on October 30th at Dar-es-Salaam, East Africa, from influenza, of Lieutenant T. Norman Browett, K.A.R., a son of Mr. and Mrs. Thomas Browett, of Hampstead, N.W., aged 29 years.

The Hon. A. E. Gathorne-Hardy.—The *Times* reports that the Hon. Alfred Erskine Gathorne-Hardy, who was chairman of the Light Railways Commission and a Railway

Commissioner, was found dead on Monday in his study with a revolver lying on the desk. He was 73 years of age, and a specialist had reported unfavourably on his health.

Lieutenant-Colonel Tremeer, D.S.O.—Lieutenant-Colonel Tremeer, D.S.O., H.M. Imperial Trade Correspondent at Johannesburg since 1903, died on November 2nd as the result of an accident.

Mr. Thomas Taylor.—The death has occurred at Buxton of Mr. Thomas Taylor, J.P., chairman of Messrs. Taylor, Tunnicliffe & Co., Ltd., manufacturers of porcelain electrical fittings, of Hanley. Deceased, who was 85 years of age, commenced business with the late Major W. Tunnicliffe in 1867, and was the pioneer in the Potteries of porcelain electrical fittings. He was a borough magistrate, served on the old Corporation of Hanley, and as a Freemason was one of the third oldest Provincial Grand Officers in Staffordshire.

NEW COMPANIES REGISTERED.

Arma Manufacturing Co., Ltd. (151,850).—Private company. Registered November 2nd. Capital, £5,000 in £1 shares. To take over the business of a manufacturer of and dealer in dry-cell batteries carried on at Jupiter Works, Holloway, N., by Edouard Armelin. The subscribers (each with one share) are:—H. S. Srelswell, 133, Queen's Road, N. 4, solicitor; J. P. Lyne, 50, Crofton Park Road, S.E. 4, solicitor. First directors: E. Armelin, 208-10, Tower Bridge Road, S.E., and H. A. French, 4, Sussex Road, Harrow-on-the-Hill.

The Electrical Co. (Glasgow), Ltd. (10,145).—Private company. Registered November 4th. Capital, £2,500 in £1 shares. To carry on the business of engineers, pattern makers, boiler makers, millwrights, fitters, iron and steel converters, founders, smiths, machine makers, metal workers, and manufacturers. The subscribers (each with one share) are:—C. McMillan, 170, Hope Street, Glasgow, writer; J. Mirrilees, 170, Hope Street, Glasgow, writer. First directors: G. B. Crockatt, J. Dickie, J. A. Hood, W. Neilson, and A. J. Smith. Registered office: 65, Bath Street, Glasgow.

Portable Tool & Engineering Co., Ltd. (151,866).—Private company. Registered November 4th. Capital, £10,000 in £1 shares (5,000 10 per cent. pref.). To take over the business of auto-tool and gauge makers and electrical and general engineers carried on by A. H. Stead, E. R. Dipple, and L. W. Watson at 243, Hertford Road, Enfield Highway, Enfield, and at Cedar Works, Enfield Highway. The subscribers (each with one share) are:—A. H. Stead, 112, First Avenue, Bush Hill Park, N., mechanical engineer; L. W. Watson, 508, Hertford Road, Lower Edmonton, N., mechanical engineer. First directors: A. H. Stead, L. W. Watson, E. R. Dipple, and J. Woodall. Registered office: 63, Finsbury Pavement, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

W. S. Laycock, Ltd.—Mortgage dated October 21st, 1918, charged on Woodend Farm, Beauchief, Derby, securing £1,900. Holders: C. Firth, Oxford, and L. J. Firth, Florence.

Small Electric Motors, Ltd.—Mortgage dated October 29th, 1918, to secure £2,500, charged on Eagle Works and land adjoining in Beckenham. Holders: S. H. G. Turney, 7, Park Square, W. Portland Place, London.

Laing, Wharton, Ltd.—Satisfaction in full on October 25th, 1918, of debentures dated July 26th, 1918, securing £500.

Mortgage debenture dated November 1st, 1918, charged on the company's undertaking and property, present and future, including uncalled capital, securing £1,000. Holders: Ministry of Munitions.

Thermo Electric, Ltd.—Charge executed outside the United Kingdom on July 2nd, 1918, to secure all moneys due at any time from the company to the Commonwealth Bank of Australia, Sydney. Property charged: Molybdenite, wolfram, wolfram bismuth, and scheelite ores and concentrates, and plant for treating same acquired by the company, and moneys to become due to the company after July 2nd, 1918, under an agreement with the Attorney-General of the Australian Commonwealth.

British Arc Welding Co., Ltd. (108,759).—Return dated August 26th, 1918. Capital, £15,000 in £10 shares. 727 shares taken up; £5,270 paid; £2,000 considered as paid. Mortgages and charges: Nil.

Bat Meter Co., Ltd. (99,327).—Return dated September 11th, 1918. Capital, £20,000 in £1 shares (12,000 pref. and 8,000 ord.). 10,683 pref. and 8,000 ord. shares taken up. £1 per share called up on 423 pref. and 15s. per share on 10,260 pref.; £8,118 paid; £8,000 considered as paid on 8,000 ord. Mortgages and charges: Nil.

W. A. S. Benson & Co., Ltd. (68,597).—Return dated May 7th, 1918. Capital £85,000 in £10 shares (2,000 pref. and 3,500 ord.). 1,908 pref. and 3,500 ord. shares taken up. £1,500 paid; £52,580 considered as paid. Mortgages and charges: £9,500.

Christy Bros. & Co., Ltd. (90,039).—Return dated July 19th, 1918. Capital, £12,000 in £1 shares (9,000 ord. and 3,000 deferred). 7,926 ord. and 3,000 deferred shares taken up. £1,826 paid; £9,100 considered as paid. Mortgages and charges: £4,600.

Electric Supply Corporation, Ltd. (52,036).—Return dated October 17th, 1918. Capital, £250,000 in £5 shares. 42,000 shares taken up; £175,000 paid; £35,000 considered as paid. Mortgages and charges: £154,914.

Everett, Edgcumbe & Co., Ltd. (84,764).—Return dated July 9th, 1918. Capital, £25,000 in 5,000 6 per cent. cum. pref., 19,997 ord., and 3 "A" shares of £1 each. 3,000 pref., 19,543 ord., and 3 "A" shares taken up. £11,996 paid on 2,500 pref., 9,495 ord., and 1 "A"; £10,850 considered as paid on the remainder. Mortgages and charges: £600.

Fors Accumulator Foreign Patents, Ltd. (108,151).—Return dated January 11th (filed August 15th), 1918. Capital, £3,000 in 962 pref. and 2,048 ord. shares of £1 each. 584 pref. and 2,048 ord. shares taken up. £132 paid on 132 pref.; £2,500 considered as paid on the remainder. Mortgages and charges: £125.

Dartmoor Electric Supply Co., Ltd. (110,871).—Return dated October 3rd, 1918. Capital, £2,000 in 10s. shares. All shares taken up. £2,000 paid; £2,000 considered as paid. Mortgages and charges: £4,000.

CITY NOTES.

French Companies.

The Constructions Electriques, of Nancy, intend to pay out of net profits of £34,000 a dividend at the rate of £4 per share for 1917-18.

The accounts of the *Maison Breguet* show net profits of £85,000 for 1917-18, as compared with £84,000 in the preceding year. It has been decided to pay a dividend of £2 per share, as against £1 16s. in 1916-17.

The Compagnie des Cables Télégraphiques records net profits of £255,000 for 1917-18, as contrasted with £144,000 in the previous 12 months. The shareholders have sanctioned the distribution of 18s. 4d. per share, as against 8s. 10d. in 1916-17.

The Société des Appareillages Electriques Grivolas states that the net profits and balance forward in 1917-18 amounted to £34,000, as compared with £25,000 in the preceding year. A dividend at the rate of 8s. per share has been declared, being the same rate as in 1916-17.

The directors of the *Société d'Applications Industrielles (Compagnie d'Entreprises Electriques)* state that they continued to devote their efforts in 1917-18 to the development of the distribution works in which the company is interested. The working of the hydro-electric works experienced an improvement, but the financial results of the steam power undertakings deteriorated under the operation of dear and inferior quality of the coal, &c. The net profits totalled £26,000, which sum has been carried forward, as in the case of £7,000 in 1916-17, so as to provide for the company's interests in works situated in districts invaded by the enemy.

German Companies.

The directors of the *Rhein. Electro-Werke A.G., of Cologne*, which undertaking belongs to the Stinnes coal mining group, report a slight loss for 1917-18, which was the first financial year.

The Brandenburg Karbid und Elektrizitats Werke A.G., of Berlin, records net profits amounting to £15,000 for 1917-18, as against £14,700 in the previous year. The directors recommend a dividend of 7 per cent., as in 1916-17.

The A.E.G. Unternehmungen A.G., of Berlin, whose share capital of £500,000 is held by the A.E.G., and whose assets consist chiefly of investments, reports net profits for 1917-18 of £34,000, as compared with £34,600 in the preceding year. It is proposed to pay a dividend of 6 per cent., being the same rate as in 1916-17.

The report of the *Kabelwerk Rheydt A.G., of Rheydt*, for the year ended June 30th abstains from referring to the course of business, mention merely being made of the increase in the share capital to £350,000. The net profits amounted to £150,000, as against £221,000 in 1916-17, and the directors recommend a dividend of 20 per cent., as in the preceding year, and a further 20 per cent. payable in war loan certificates.

The Elektrizitats A.G. vorm. H. Poge, of Chemnitz, reporting on the year 1917-18, states that orders for munitions, which in the previous year were twice as large as those for peace electrical products, now only form two-thirds of the latter. Although electrical manufactures were still of importance for the war, the directors believed that the transposition to normal articles had now for the most part taken place. The net profits earned last year amounted to £146,000, as against £127,000 in 1916-17, and the dividend is 28 per cent., as compared with 20 per cent.

The accounts of the *Elektro-Werke A.G., of Berlin*, whose share capital of £250,000, and loans made by the A.E.G. to the extent of £1,952,000, were taken over by the Imperial Treasury last autumn in exchange for Treasury bills, show a gross surplus of £54,000 for 1917-18, as compared with £6,000 in the previous year. The company's works are engaged on the supply of energy to the Imperial Nitrogen Works from the power station in the Bitterfeld lignite district. After defraying general expenses, interest on mortgages and loans, and setting aside £11,000 for depreciation, there remains a surplus of £1,700, which serves to extinguish the deficit brought forward from the previous year.

Escher, Wyss & Co.—The report for 1917-18 of Escher, Wyss & Co., of Zurich, states that it was possible further to increase the production, although the difficulties in obtaining raw materials and in forwarding manufactures were becoming more pronounced. The continued advance in the cost of raw materials was specially prejudicial to the company, as the orders almost entirely represented long-term contracts. The orders were abundant, and those on the books at the end of the financial year were greater than at the beginning. As net profits the accounts show the sum of £26,000, as contrasted with £20,000 in the previous year, and a dividend of 5 per cent. is proposed on the share capital of £260,000, being the same rate as in 1916-17.

United Electric Tramways of Caracas, Ltd.—Including £1,899 brought forward, the net revenue balance at June 30th was £19,194. Dividend 7 per cent., less income-tax, carrying forward £7,294. Percentage of operating expenses to gross receipts 49.20, against 52.85. Passengers carried 5,499,697, against 4,984,206.

British Westinghouse Electric & Manufacturing Co., Ltd.—The *Financial Times* says that details of the proposed revision of the capital of this company, which was stated at the last meeting to be in preparation, will be laid before shareholders on Tuesday next. The directors will then propose that the company be empowered to form subsidiary undertakings at home and abroad. The capital will be increased to £6,395,000 by the creation and issue of 5,000,000 ordinary shares of £1 each, which, after an 8 per cent. non-cumulative dividend has been paid on the 685,000 preference shares of £2 each, will rank for 30 per cent. non-cumulative, before the deferred shares. After the latter have been paid 7½ per cent., ordinary shareholders will receive the balance of profits. The board's fees are to be fixed at £11,000 a year, excluding the managing director and local boards. Preference shareholders will be asked, when ordinary shareholders have consented to the conversion of their capital into preference, to permit the modification of their rights, so that the shares rank equally with the existing ordinary shares for a non-cumulative preferential dividend of 8 per cent. before anything is paid on the new ordinary or the 500,000 deferred shares of 1s. each.

Cape Electric Tramways, Ltd.—Profit £86,512. Net credit balance after providing for debenture charges is £42,391. £12,000 to reserve; dividend 5 per cent. on ordinary shares; £5,830 carried forward. Passengers carried 26,444,465, earning £264,137, against 23,752,016 earning £231,105 in 1916-17. High cost of supplies and materials and wages has prevented any reduction in ratio of working expenditure, but profits earned on account of the heavier traffic show an increase. Maintenance and repairs charges are likely to further increase in the future owing to arrears, which have to be made good as early as possible.

North Metropolitan Electric Power Supply Co.—According to the *Financial Times*, the directors have convened an extraordinary general meeting, for 26th inst., for the purpose of considering a resolution authorising the company to raise the remaining unissued portions of the capital, together £259,980, by the issue of preference shares ranking *pari passu* with those existing.

Manaos Tramways and Light Co., Ltd.—Gross earnings for the year ended April 30th £122,495, against £120,387; operating expenses £84,003, against £82,511. After providing for debenture and loan charges, loss on exchange, and putting £5,000 to renewals, £11,856 remains to carry forward.

Companies to be Struck Off.—The following are to be struck off the Register within three months unless cause is shown to the contrary:—

British Gas Traction Co., Ltd.
Grindell-Matthews Wireless Telephone Syndicate, Ltd.
Pressed Miners' Gas-Indicating Electric Lamp Co., Ltd.
Meldrum Bros., Ltd.

International Light & Power Co., Ltd.—Net profits to June 30th, after providing for debenture charges and reserve, were £17,024. The surplus brought forward was raised to £34,100, which is to be carried forward.

Stothert & Pitt, Ltd.—Dividend, 10 per cent., free of tax, on ordinary shares. £11,394 carried forward.

Indian Electric Supply and Traction Co., Ltd.—Interim dividend 2½ per cent., less tax, for the half-year.

STOCKS AND SHARES.

TUESDAY EVENING.

THE news of the signing of the armistice caused so profound a gratification in the Stock Exchange as to come almost with a shock. Prices became buoyant, and there has been a large volume of trade doing already. With the air filled with excitement and bunting, it is, of course, difficult to negotiate orders to buy and sell securities, but business has struggled as well as it could against the joyful handicaps, and in many departments advances have been secured as the result of the triumphant conclusion of negotiations in the field.

The main improvement, so far as the electrical markets are concerned, has come in railway stocks, but rises have also occurred in electric lighting, telegraph, and a few manufacturing issues. In addition to this, renewed strength is shown by foreign descriptions, in which Anglo-Argentine Tramways and Brazilian Tractions stand out with particular prominence.

A string of rises has taken place in the electricity supply list. Amongst those which have benefited, the West End companies stand out prominently, though the City shares are by no means neglected. Edmundsons have moved up to 10s. The investor is keen on buying the shares, and is prepared to pay what would have been regarded a few months ago as handsome prices for them. Expectation now looks well forward, and consideration of dividends leaps over the next half-year or two, hoping for a return to more normal and more successful times in the course of the next few years. Bromptons are better, so are Charing Cross, Chelsea, City of London, Metropolitan, Kensington, St. James's, London Preference, and Westminsters. Such a record this market has not seen since the outbreak of war.

Manufacturing shares are steady. British Westinghouse preference recovered to 2½, but Electric Constructions are a little easier at 1 5/16. Marconis are a much quieter market than they have been lately, and the price of the parent shares has gone back to 4½. Americans keep good at 32s. 6d., and the other subsidiaries are a firm market.

Changes in the telegraph and telephone list are comparatively small. Indo-European shares have risen £1, but Eastern Extensions and Westerns are both ¼ lower, though West India & Panama at 1½ have regained the 1/16th they lost last week. Amongst home railway stocks, the strength of the market as a whole has helped the Underground list materially. Underground Incomes have risen two points to 91, and the 1s. shares of the company at 9s. 6d. are 1s. 6d. up on the week. The ten-pounders have gained 10s. at 3½d. Metropolitans further improved upon their big rise of a week ago, and are ½ higher at 30½. British Electric Traction ordinary rose to 50½.

The foreign traction group is good throughout. Anglo-Argentine Tramways shares of both classes are substantially better. Brazilian Tractions at 60 are 2 points up, and rises ranging from 1 to 2 points have been secured by British Columbia and Mexican issues. Calcutta Trams at 7½ are 5s. higher. The difficulty once more is to get shares.

The rubber market is goodish, though the amount of business passing is not great. Armament shares are by no means as weak as some expected to find them on the probable termination of the war. Copper and tin mining descriptions show little variation, this being due to the uncertainty felt with regard to the outlook for base metals now that the armistice is signed.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1916.	Dividend 1917.	Price Nov. 12, 1918.	Rise or fall.	Yield p.c.
HOME ELECTRICITY COMPANIES.					
Brompton Ordinary	9	10	6½	+ ¼	£7 13 10
Charing Cross Ordinary	5	4	3½	+ ⅛	5 14 4
do. do. do. 4½ Pref.	4½	4½	3⅝	—	6 13 4
Chelsea	9	5	3⅝	+ 1/16	7 8 2
City of London	8	8	13½	+ ¼	5 18 6
do. do. 6 per cent. Pref.	6	6	10½	+ ⅛	5 18 5
County of London	7	7	11	—	6 7 3
do. do. 6 per cent. Pref.	6	6	10	—	6 0 0
Kensington Ordinary	6	7	6½	+ ¼	6 13 4
London Electric	Nil	Nil	1⅛	—	Nil
do. do. 6 per cent. Pref.	4	5	3½	+ ⅛	6 9 0
Metropolitan	3	4	3½	+ 1/16	6 3 1
do. 4½ per cent. Pref.	4½	4½	3⅝	—	6 18 6
St. James' and Pall Mall	8	9	7	+ ½	6 8 7
South London	5	5	3	—	6 13 4
South Metropolitan Pref.	7	7	20/6	—	6 16 7
Westminster Ordinary	7	9	7	+ ¼	6 8 7
TELEGRAPHS AND TELEPHONES.					
Anglo-Am. Tel. Pref.	6	6	99	—	6 1 0
do. Def.	1½	1½	23⅜	—	6 8 6
Chile Telephone	8	8	7½	—	5 6 8
Cuba Sub. Ord.	7	7	10½	—	*6 13 4
Eastern Extension	8	8	15⅝	— ⅛	*5 0 10
Eastern Tel. Ord.	8	8	161½	—	*4 19 1
Globe Tel. and T. Ord.	7	7	14½	—	*4 16 5
do. do. Pref.	6	6	10½	—	5 14 3
Great Northern Tel.	24	22	84	—	6 9 5
Indo-European	13	13	58½xd	+1	5 11 0
Marconi	15	20	4½	— ⅛	4 4 0
Oriental Telephone Ord.	10	10	3½	—	2 17 2
United R. Plate Tel.	8	8	7⅞xd	—	*5 5 0
West India and Panama	6d.	1/6	1½	+ 1/16	*3 12 6
Western Telegraph	8	8	16⅝	— ⅛	*4 14 10
HOME RAILS.					
Central London Ord. Assented	4	4	65½	—	6 2 2
Metropolitan	1	1	30½	+ ½	3 6 1
do. District	Nil	Nil	20½	—	Nil
Underground Electric Ordinary	Nil	Nil	9½	+ ½	Nil
do. do. "A"	Nil	Nil	9/6	+1/6	Nil
do. do. Income	6	4	91	+2	*4 8 0
FOREIGN TRAMS, &c.					
Adelaide Sup. 6 per cent. Pref.	6	6	42	—	6 6 4
Anglo-Arg. Trams. First Pref.	5½	5½	4	+ ½	—
do. do. 2nd Pref.	5½	—	3⅜	+ ⅜	—
do. do. 5 Deb.	6	5	77½	+1½	6 9 0
Brazil Tractions	—	—	60	+2	—
Bombay Electric Pref.	6	6	103½	—	5 11 7
British Columbia Elec. Ry. Pfds.	6	6	96½	+2½	7 10 —
do. do. Preferred	Nil	Nil	47½	+ ½	Nil
do. do. Deferred	Nil	Nil	45½	+1	Nil
do. do. Deb.	4½	4½	62	+ ½	6 17 3
Mexico Trams 5 per cent. Bonds	Nil	Nil	67	+2	Nil
do. 6 per cent. Bonds	Nil	Nil	51	—	Nil
Mexican Light Common	Nil	Nil	37½	—	Nil
do. Pref.	Nil	Nil	50	—	Nil
do. 1st Bonds	Nil	Nil	72	+1	—
MANUFACTURING COMPANIES.					
Babcock & Wilcox	15	15	8⅜	—	4 2 4
British Aluminium Ord.	10	10	1⅛	—	5 12 4
British Insulated Ord.	20	20	2½	—	4 9 0
British Westinghouse Pref.	7½	7½	2⅜	+ 1/16	5 14 0
Callenders	20	25	9⅜	—	6 8 0
do. 5 Pref.	5	5	5⅛	—	—
Castner-Kellner	22	20	3⅜	—	5 10 4
Edison-Swan, "A"	—	—	⅜	—	Nil
do. do. 4 per cent. Deb.	4	4	75½	—	5 6 0
Electric Construction	7½	10	1 5/16	— 1/16	7 12 6
Gen. Elec. Pref.	6	6	10⅜	—	6 2 4
do. Ord.	10	10	18	—	*5 11 1
Henley	25	25	9½	—	5 11 2
do. 4½ Pref.	4½	4½	4	—	5 12 6
India-Rubber	10	10	17½	—	*5 14 3
Telegraph Con.	20	20	49	—	*4 18 0

*Dividends paid free of Income Tax.

ASH AND CLINKER PLANT.

In modern electricity works the removal of boiler-house ashes is a matter of considerable importance, particularly at the present time, when the percentage of ash is so high. For large plants attention is drawn to the pneumatic suction system. In spite of its advantages, the number of such installations in this country is quite small. American practice shows up better in this respect. Pneumatic ash plant is now being employed wherever the size of the works and the quantity of ash to be removed justify the initial outlay.

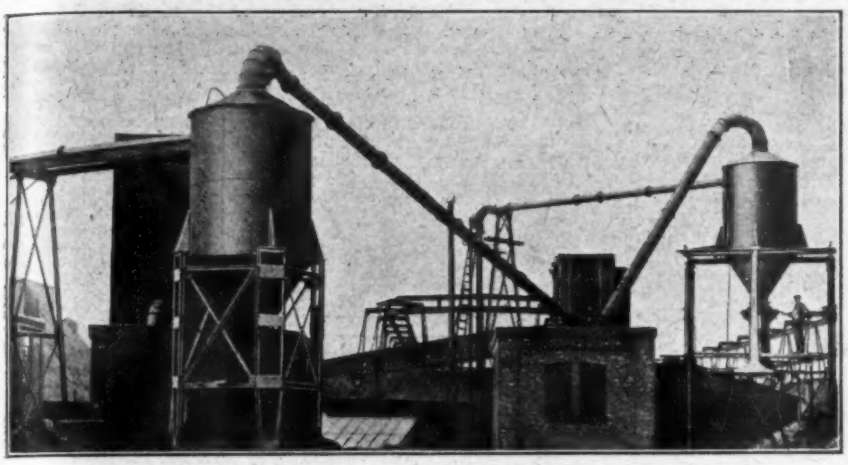


Fig. 1.—View of Fan House and Receiving Hopper.

Pneumatic Ash Plant.—The following description relates to an installation recently carried out to the order of His Majesty's Government. In general, however, it may be taken as typical. The plant is arranged to serve 32 Lancashire boilers, from which it takes the clinker and ash and deposits them in two steel ash tanks or receivers. Auxiliary branch lines are provided for cleaning the boiler flues, economisers, chimney bottoms, and so forth.

The installation comprises a motor-driven rotary exhauster, foul air cleanser, two ash tanks, and the necessary pipe lines for taking the ash or other material to the tanks. Holes are provided in the floor plates in front of each boiler flue, each hole being fitted with a dumping hopper, grid, and an air cut-off. As the ashes are drawn from the cleaning chamber at the back of the furnace bars of the stokers, they are dumped through these holes direct into the ash pipe, and are carried by suction into the ash tanks.

It is one of the curious properties of suction plant that wear only takes place to any degree at the points where the pipes are subject to a change of direction, viz., at the actual bend. The long, straight pipe lines do not suffer to anything like the same extent. The reason for this appears to be that the ashes are carried by the air in the centre of the pipe where the air is travelling at its highest velocity, and therefore they do not touch the pipes. At the bends, however, where deflection of air takes place, the ashes are constantly striking against the pipes with the inevitable result. Provision is made for this by placing special patent bends wherever the ash pipes are subject to change of direction. The wearing parts of these points are of exceedingly hard chilled iron and are easily renewable. For much the same reason there is a possibility that pieces of ash or clinker may be driven out of the air current and become lodged in the pipes at the bends. To provide against this contingency, a hand-hole with air-tight door is placed at each end of every bend to enable any such obstruction to be easily and quickly removed.

The ash tanks, two in number, are cylindrical in shape, and have a capacity of 20 tons each. They are built of mild steel plates lined with brickwork, angle iron rings being provided inside the tanks to support the lining. The top of each tank is coned to meet the end of the ash pipe line, whilst the bottom is hoppered to allow the ashes to be freely discharged by gravity. The discharge valves, water sprays, &c., are arranged inside the upper-coned portion of each tank, and a pipe is taken from the lower portion into a sump to get rid of any excess water which may have accumulated. This pipe is water-sealed in the sump. A large pipe is connected to the upper portion of each tank, and through it the foul air passes to a patent water-sealed cleaner or scrubber. This apparatus consists of a vessel filled with rows of water-sprayed bafflers, which catch any dust or fine particles of ash which might otherwise be carried into the exhauster. The large water seal at the bottom of the cleaner acts as a safety valve in case of undue pressure or vacuum in the apparatus.

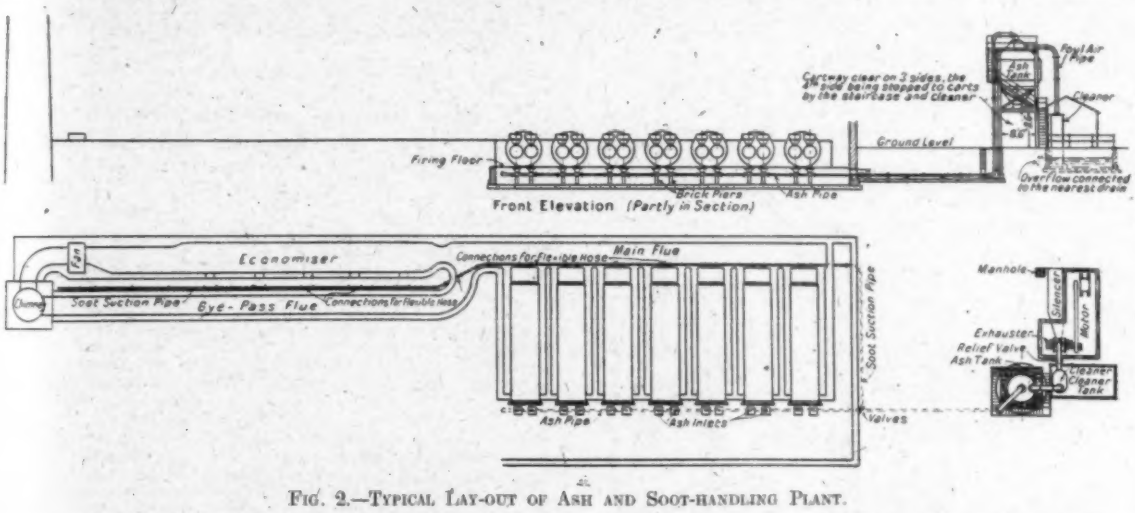


Fig. 2.—Typical Lay-out of Ash and Soot-handling Plant.

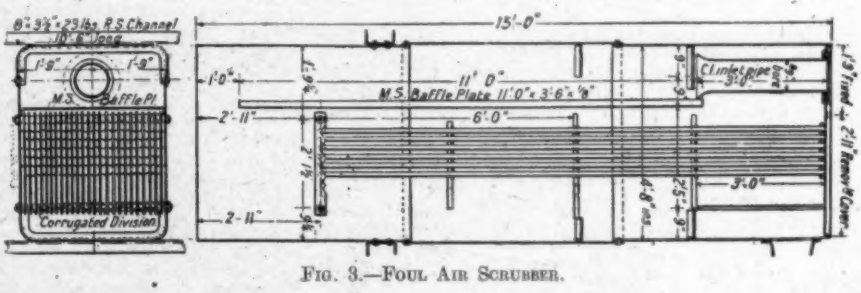


Fig. 3.—Foul Air Scrubber.

The method of discharging the ashes from the tank is as follows:—A patented balanced discharge valve is provided at the outlet from each tank, which allows of any required

quantity of ashes being immediately delivered into the railway or other trucks drawn underneath for the purpose, or, as in some other installations, dropped through a shoot into barges in a canal. The rotation of a hand-wheel conveniently placed for operating, first loosens and then releases a catch, allowing the sealing door or valve to drop, which it does gently, being balanced. The rotary cut-off which actually closes the bottom of the ash tank is then opened, and as much ash deposited as required into the truck, when it is again closed. When the sealing valve is returned into its place, the catch automatically swings back into position, and,

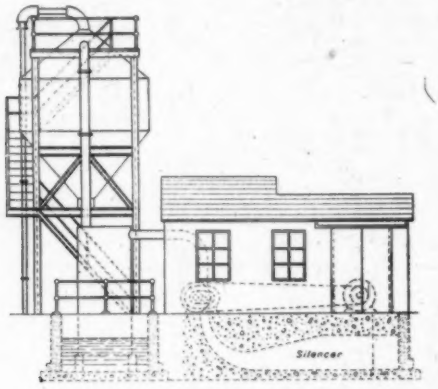
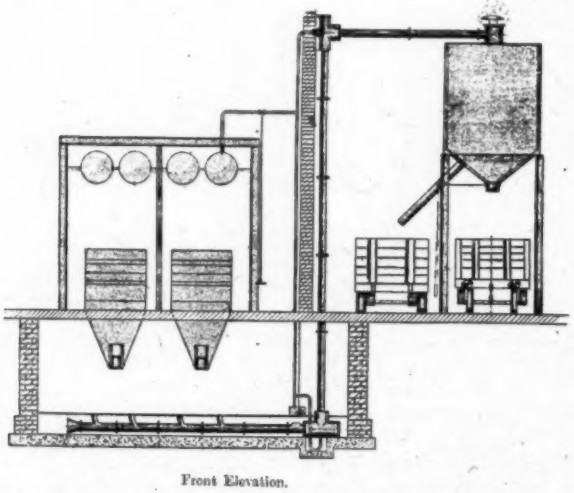


Fig. 4.—Arrangement of Exhauster, Cleaner, and Ash Receiver.

reversing the hand-wheel above referred to tightens up the whole mechanism again, rendering it completely air-tight.

The pipe line for removing the flue dust from the flues, economisers, and chimneys is entirely separate from the ash pipes. The flue dust is removed from the flues and economiser chambers through short flexible pipes, which are removable, and can be fixed to whichever branch it is desired to use. The flues and economiser chambers are provided with cover plates for closing down when the dust is not being removed. The suction end of each pipe is provided with a nozzle of patented design. The motor-driven air exhauster is of the rotary blower type, and the suction required in this plant is not much more than half that usually used in grain elevating plants, with a commensurate reduction in the motive power required and in the cost of operating. Several very large plants of this type have been installed recently.

Steam Suction Conveyors.—The need for a simple ash suction conveyor adapted to the requirements of small boiler-houses, and to installations where the capital cost of a pneumatic suction plant was not warranted, led to the introduction of a simple form of steam suction conveyor, made



Front Elevation.

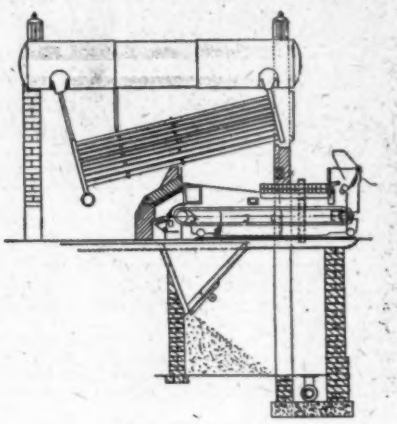
Fig. 5.—Typical Installation of Steam Suction Conveyor Delivering Ashes into an Overhead Storage Tank.

by Messrs. Ed. Bennis & Co., Ltd. This form of conveyor is adaptable to confined spaces, as a 6-in. or 8-in. pipe line can be placed where the space for an ash elevator is not available, whilst awkward curves and bends can be negotiated with ease. Moreover, it is not necessary to provide a large ash hopper, as ashes may be discharged, if desired, direct into a railway wagon or cart. There are no moving parts, so that wear and tear are reduced to a minimum.

This conveyor consists of a heavy cast-iron pipe line, made of special hard metal mixture. The pipes are fitted with patented bends, tees, and corner-pieces, which have renewable, chilled-metal wearing parts. For removing the ashes and clinker, a pipe line is laid in the boiler-house, generally under the floor plates, and ash intakes are provided in the floor in front of the boilers. Six-in. or 8-in. pipe lines are the sizes most in demand; the latter is generally regarded as the most convenient as it will take the larger lumps of clinker. The holes into the pipe are provided with hand valves, through which the ash is raked into the pipe. The economisers and flues are cleaned by similar means, branch lines of smaller size, usually 4 in. diameter, being used for this purpose.

When the steam valve is opened, the ashes are raked into the intake of the conveyor, and conveyed by suction to the overhead hopper, and thence removed as desired. The ashes can be elevated to a considerable height, and can also be carried comparatively long distances, say 200 or 300 ft. from the boiler house.

A special mixture of metal having high abrasion resistance qualities, is used for the cast-iron pipes. This metal is similar to that used for the troughs in the Bennis U-link chain conveyors, many of which have given 15 to 20 years' continuous service. The metal in the pipes is approximately 1 in. thick, and the pipes are faced at the ends. A gasket, usually of asbestos and copper wire, is employed. The bends are built up with an outside casing of cast-iron, with heavy chilled cast-iron liners to take the wear. The cover of the



Cross Section.

Fig. 6.—Typical Installation of Steam Suction Conveyor Delivering Ashes into an Overhead Storage Tank.

case can be easily removed to allow the liners to be lifted out and renewed. The liners are cast of a special abrasion-resisting iron, and highly chilled.

The steam nozzle is a separate fitting, bolted to the side of the case, and may thus be inspected or renewed at any time without disturbing the bend.

In suction conveyors it is found by experience that it is not desirable to have gently curved long bends. Their disadvantage lies in the fact that as the material carried through the pipes always tries to travel in a direct line, the ash or clinker strikes the pipe at the bend, rebounds, and strikes the pipe at another portion of the bend, this process being continued until the bend is passed. This causes scoring along the whole of the curve, and produces considerable wear and tear, whereas the sharp angled bend is so arranged that the wearing part is very much thicker at this point, and the steam nozzle being placed at the bend helps to keep the ash and clinker from hitting the inside of the liners. These bends may be 90 deg., 135 deg., or any other angle to suit the particular circumstances.

Ash Elevators.—The removal of ashes on the bucket elevating and storage system is deservedly popular, especially in small plants, on account of its simplicity and durability. A large number of such plants have been erected in works of all kinds. The view in fig. 7 shows an interesting self-contained plant in a Lancashire textile mill.

In this case the ashes are dumped into an 8-in. bucket elevator placed in a corner of the boiler-house, and are carried by the elevator into an overhead bunker, formed out of cast-iron plates carried on rolled steel joists, having a capacity of about 10 tons. The bunker is completely covered in to prevent the dust flying about.

A rotary cut-off valve, operated by a hand-lever from the ground level, is placed at the outlet of the bunker. This enables the ashes to be delivered into carts as required, ample head-room being allowed for this purpose.

The three boilers at this mill are fitted with "Bennis" elevator placed in a corner of the boiler house, and are supplied with coal by means of three independent bucket elevators. The whole plant is giving great satisfaction, and for a small installation represents, we are informed, a very near approach to perfection in mechanical coal and ash handling combined with maximum boiler efficiency.

Another method of ash removal, which finds favour in certain circumstances, is that where the ashes are raised by an incline from the ash gallery beneath the boilers, and delivered into a storage tank having a capacity of about 10 tons or more

if desired. A valve fixed to the outlet from the tank and operated by a chain from the ground level enables the ashes to be discharged, as required, into a railway truck beneath. In this case, the incline is placed at the end of the boiler-house, and as the ashes are withdrawn from the boilers they are trimmed into trucks, which run on rails on the floor of the ash gallery. Each truck has a capacity of from 6 to 10 cwt. The trucks are pushed along to the end of the gallery, and tipped direct into another wagon, which is taken up the incline and automatically tipped into the bunker.

Fig. 7.—Ash Elevator and Covered-in Storage Tank.

The driving gear gives a winding speed of about 100 ft. per minute. A cut-off switch is placed on the structure at the top of the track, and when the truck reaches a certain point, the motor is automatically cut out to prevent over-winding. A similar device is fixed at the bottom of the track. This plant is in successful operation in a large Durham power station.

For the foregoing particulars and illustrations we are indebted to Messrs. Ed. Bennis & Co., Ltd., by whom the plant described was made and installed.

FEDERATION OF BRITISH INDUSTRIES.

The annual general meeting of this Federation was held on October 29th, 30th, and 31st at the Connaught Rooms, London. A special general meeting was held on the 29th ult., when the new constitution was formally approved, and on October 30th the retiring President, Sir R. Vassar-Smith, delivered his presidential address. He remarked that the Federation had nearly doubled its membership, and considerably more than doubled its strength. A year ago it represented 581 members and 78 trade associations; to-day the membership was 951, in which number 164 trade associations were included. He congratulated the committee which had drawn up their new constitution. If an organisation of that size was to avoid stagnation it was essential to provide it with an elastic constitution, so that each section might make its voice duly heard in the governing body. Such a consideration they now had; and he appealed to all connected with the group and sub-group committees to ensure that vital force might be breathed into the skeleton which had been evolved. A distinctive feature of the past year had been the organisation of the Parliamentary side of their work. Under the chairmanship of Sir Rowland Barran, the committee of this group had met with considerable success. No one could doubt that the Federation was justifying its existence by practical results. It was also evident that their past activities were founded on sound ideals. In the past it had been the object of unjustifiable criticism and suspicion, but that was fast dying out, and he hoped that the discussions which were to follow would put an end to it altogether. The President went on to refer to the various questions which were to be discussed, pointing out that the most urgent and difficult was the tariff question. They were now within sight of being able to present to the Government a national policy which would meet the requirements and safeguard the interests of every trade. Another vital matter of State policy was taxation. The resolution which would be proposed on this subject sought to define the principles which should guide the Government in apportioning taxation. Other important subjects they were to consider were labour, education, housing, and the organisation of industry through trade associations. It would add enormously to the strength of the Federation and to British industry generally if their huge membership would definitely adopt the policy of buying each others products in preference to foreign goods. Finally, it would be impossible to direct the process of reconstruction effectively without the co-operation of industry.

Sir Vincent Caillard was then elected President for the coming year.

Sir Algernon Firth proposed the first resolution (which was carried unanimously) impressing on the Government and country the necessity of maintaining the principle of private ownership of capital, and encouraging the free flow of capital into industry, and of preserving and encouraging that spirit of individual enterprise and initiative which was the vital principle of national life. In the course of a lengthy address, he pointed out that when the war commenced there were only 345,000 holders of British Government securities; now there were some 16½ millions, while there were 11 million accounts in the Post Office Savings Bank, and over two millions in the Trustee Savings Bank. After the war they must see that these savings would be encouraged to flow into productive industry. If the incentive to individual effort was removed and replaced by any system of governmental or communal control, the death-knell of the prosperity of their industries would be sounded. The interests of the community were best served by the fullest opportunity being afforded for the free play of individual talent. They wanted individual effort encouraged, security for their business, and not meddlesome interference, and that support of their workers which they could secure if left alone.

The next resolution, moved by Mr. Dudley Docker, emphasised the supreme importance of British industry, and urged upon the Government the necessity of recognising the importance of industrial interests, and of consulting the representatives of employers no less than of employed. He said that industry must recognise that it owed a duty to the community, and in pursuance of this duty the Federation would endeavour by co-operative and other means to raise production to the highest level both of quantity and quality, to reduce expenses of distribution and the cost of goods to the consumer, and to ensure the maintenance of industrial peace, and the enjoyment by all those engaged in industry of the fullest share practicable in the creation and distribution of wealth. It was for manufacturers to see that the industrial system did not lead to results which were not socially justifiable. In the past they had been careless of this aspect of the case, and they must recognise that many of the results of the old system were not justifiable. In these respects there must be an alteration, and they were all prepared to do their best to make the necessary alteration. The Federation afforded the best means for obtaining this result.

Sir Vincent Caillard moved a resolution on the subject of national economic policy, remarking that they had reached the point when they could look at the subject free from old prejudices and controversies. Their object was to frame a policy that should safeguard the requirements of all industrial interests whether by way of protective duties, maintenance of free import, subsidy, transport facilties, or otherwise, and thus enable each industry to attain its maximum productions. The whole strength of the country and the whole well-being of all classes, and of labour especially, rested on production.

The resolution also included declarations in favour of preferential treatment for the Empire and our Allies, and urged the Government to set about the preparation of provisional schemes immediately in order to apply a practical test to the problems involved.

The next resolution, moved by Mr. T. Biggart, urged the Government so to regulate and apportion taxation as to encourage the flow of capital into industry and increased production, the provision of adequate reserves to meet the cost of renewals and extensions, and the maintenance by manufacturers of adequate stocks.

On October 31st the first resolution affirmed the importance of improving education, both primary, secondary, and adult, with a view to enriching the mental life of the nation and developing individual character and initiative, and enabling every citizen to take his proper place in the activities of the community. The mover, Mr. F. W. Gilbertson, said that education would be more important in the future, especially of the young men, because so many educated men had died in the war. There was no one who was so well able to form an opinion as to the success of the educational methods as an employer, because he saw the results. A great deal of good would follow from a body like this taking a real interest in the subject.

Bailie John King, of Glasgow, moved a resolution on "Housing."

Sir Robert Hadfield, Bart., moved a resolution dealing with technical education, and inviting the co-operation of the Government, organised labour, and educational authorities, with a view to improving technical and higher commercial education, to promoting the employment by manufacturers of students who had taken advantage of the courses provided,

and to securing the introduction into industry of an adequate and regular supply of suitably trained personnel. Sir Robert spoke of the great field which existed for the improvement of technical education, especially in the matter of science. It was remarkable that in the Civil Service examinations science was not a compulsory subject. He hoped the Federation would see to it that some change was brought about. He also pointed out the crying need for a building in London to house technical societies and organisations which at present were houseless. He hoped something in the way might be done in connection with the big building for housing this Federation, which they all had in mind. It would greatly help on technical education to have a proper technical centre where they could meet together.

Mr. Frank Moore moved a resolution affirming that the Federation viewed with grave concern the recurring instances of industrial unrest, and recorded its approval of the general principles underlying the first report of the Whitley Committee, and inviting the group and sub-group committees to consider how far these principles could be applied to their industries. When the report came out he was much prejudiced against it, but on fuller consideration of it he was converted to the main idea of the scheme. Industrial Councils, he felt convinced, led to greater harmony between employers and employed. Their interests were the same, and with the good feeling the report would bring about there should be no fear of any ill result.

Mr. Max Muspratt moved that with a view to consolidating the industries of the country and reducing the speculative fluctuation in prices, members were recommended, as far as possible, to draw their requirements of manufactured products from members of the Federation.

Mr. H. R. Armitage moved a resolution impressing upon manufacturers the great advantage to be derived from co-operation and the organisation of industry through trade associations.

The last resolution was one approving the general lines of the policy of the Minister of Reconstruction in forming joint committees of employers and workpeople to advise the Government on reconstruction questions, but emphasising the necessity of adapting this policy to suit the conditions of the different trades.

At the luncheon, Sir Vincent Caillard presided, and in proposing "The Guests," included the names of Sir Auckland Geddes, Dr. Addison, Mr. Hewins, and Mr. Wardle. He remarked that manufacturers did not always see eye to eye with the Government. They recognised the great and sterling qualities of those gentlemen, and the tact and courtesy which they invariably displayed. The present gathering would afford those gentlemen an exceptional opportunity of saying anything they wished to say to British industrialists to a great assembly which represented pretty well the whole industrial energies of the Kingdom. They were very nearly a thousand in membership; they would probably be a thousand in the course of a few weeks; they represented through direct membership of firms and associations something like 16,000 manufacturing firms in this country, and an aggregate of £4,000,000,000 of capital. They would be glad to hear from their visitors the Government's intentions with regard to the control of industry, which they recognised as a necessity for some period after the war, but which they hoped would be relaxed as quickly as possible in order that industry may have the free play which was its life blood. They would like to hear something about the plans for demobilisation, and particularly those for the employment of the soldiers and sailors. They would also like to hear something about reconstruction—not the appointment of committees, but decisions taken and results attained. They would also like to hear something as to the future economic policy of the country.

Sir Auckland Geddes, who was the first to respond, said the war was drawing to its close. It was not long before they would be faced with the problems of reconstruction. It was a difficult question. Our reconstruction must have the effect of making every family in the State feel that its position and health and well-being were of real interest to the State. He did not wonder that there was industrial unrest. He only wondered there had not been revolution years ago with regard to health and housing. Only if production was carried on upon a larger scale could they meet the cost of the war and the cost of peace. The problems of the coming peace were more dangerous than any of the problems of the war. He would like to see the old parties done away with, and a great party of the centre, a new commonwealth party, formed for the common weal.

Dr. Addison, whose speech was briefly referred to in our pages last week, dealt with the subject of demobilisation, and said the first business of the Government would be as quickly as possible to re-establish the great basic industries of the country. The resolution on reconstruction passed by the Federation exactly expressed his own policy. He formally accepted the Federation's offer of co-operation.

Mr. Hewins, Under Secretary for the Colonies, dealt with the economic policy of the Government. They were not dealing with an ideal world, but were dealing with the circumstances and conditions of the British Empire with regard to foreign countries. Whether Protection or Free Trade were good things in the abstract he did not know; the question was whether as regards any particular trade or industry tariffs should be set up. It was a question of the particular requirements of the particular trades, and the resolution passed by the Federation was, he considered, on absolutely sound lines. He repudiated the suggestion that the Government had never declared its policy. In the Paris resolutions, and the resolutions of the Imperial War Conference in 1917, the Government had set out its intentions. What had to be done now were matters of detail. The reasons why the Government had not made a statement as to economic policy was not that the Government had not a policy. It was carrying out that policy effectively, but they could not deal with these questions as a set of philosophers.

Mr. G. J. Wardle, Parliamentary Secretary of the Board of Trade, said he hoped the time was not far distant when, instead of having separate congresses of employers and workers, they might have joint conferences. They must have self-government of industries, but not with Labour shut out. If the Kaiser must go, the autocrat of industry must go too. Employers would have nothing to lose, and the employed much to gain.

NEW PATENTS APPLIED FOR, 1918.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens (successors to W. P. Thompson & Co., of London), Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

17,527. "Electrical recording graph." T. H. Escott, R. G. Horton & W. Leeming. October 28th.
17,549. "Electric furnaces." H. A. Kent. October 28th.
17,567. "Electrical fuse." H. E. Trent. October 28th.
17,575. "Switch control for automobile electric tail lights." D. G. Zalocostas. October 28th.
17,621. "Magneto sparking plugs." H. D. Killick. October 29th.
17,631. "Oscillators or vibrators for wireless telegraphy, &c." M. Compare & Comparri Wireless Control Syndicate. October 29th.
17,639. "Systems of frequency transformation." British Thomson-Houston Co. (General Electric Co., U.S.A.) October 29th.
17,650. "Electrolysing solution of nickel salt." C. Hebrlein. October 29th.
17,660. "Control of ignition devices for internal-combustion engines." W. W. Cunliffe. October 29th.
17,722. "Systems of electrical distribution." British Thomson-Houston Co. (General Electric Co., U.S.A.) October 30th.
17,708. "Electricity generating and supply means." Brush Electrical Engineering Co. & H. Roberts. October 30th.
17,731. "Electrically-heated fabrics." A. S. Lucas. October 30th.
17,735. "Electrical fitting connections." J. A. McKay. October 30th.
17,745. "Electrodes for sparking plugs for internal-combustion engines." E. H. Jones. October 30th.
17,747/8. "Sparking plugs for internal-combustion engines." E. H. Jones. October 30th.
17,754. "Manufacture of electric dry batteries." Burgess Battery Co. October 30th. (U.S.A., October 20th, 1917.)
17,777. "Electrical switches." A. C. Robinson. October 31st.
17,794. "Electric lampholders." T. L. Jones. October 31st.
17,795. "Sparking plugs for internal-combustion engines." F. A. L. Johnson. October 31st.
17,817. "Automatic voltage or current regulator for electrical generators." E. T. Cook & S. Murphy. October 31st.
17,824. "Separators for electric accumulators." E. F. Ablitt. October 31st.
17,837. "Non-spillable battery cells." E. H. Naylor & S. F. Tyler. October 31st.
17,841. "Detective and protective devices for electric cables." C. J. Beaver, E. A. Claremont & A. F. W. Richards. October 31st.
17,932. "Method of electrically treating steel, &c., and hardening steel, &c." W. J. Kradett. November 2nd.
17,947. "Sparking plugs for internal-combustion engines." D. McGregor. November 2nd.
17,962. "Galvanic cells." M. L. Kaplan. November 2nd.
17,972. "Galvanic cells." M. L. Kaplan. November 2nd.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1917.

6,536. Apparatus for use in testing electric lamps and the like. British Thomson-Houston Co. (General Electric Co., U.S.A.) May 8th, 1917. (119,668.)

13,019. Apparatus for driving magnetos in connection with internal-combustion engines. Soc. Lorraine des Anciens Etablissements de Dietrich et Cie. de Luneville. September 30th, 1916. (119,672.)

13,083. Apparatus for driving magnetos in connection with internal-combustion engines. Soc. Lorraine des Anciens Etablissements de Dietrich et Cie. de Luneville. January 29th, 1917. (Addition to 13,019/17.) (119,674.)

13,084. Apparatus for driving magnetos in connection with internal-combustion engines. Soc. Lorraine des Anciens Etablissements de Dietrich et Cie. de Luneville. March 3rd, 1917. (Addition to 13,019/17.) (119,675.)

14,451. Dynamo-electric machines. Submersible & J.L. Motors, Ltd., and C. W. Durnford. October 5th, 1917. (119,683.)

14,557. Electric snap switches. J. S. Withers (Hart & Hegeman Manufacturing Co., U.S.A.). October 8th, 1917. (119,689.)

14,750. Coupling devices for electric cables. Submersible & J.L. Motors, Ltd., & C. W. Durnford. October 11th, 1917. (119,704.)

16,492. Starters for electric motors. Electric & Ordnance Accessories Co. & N. G. Langrish. November 10th, 1917. (119,736.)

17,136. Means for adjustably connecting a magneto and a gearbox with a common bracket of a motor-cycle. S. C. Poole, F. W. A. Smith & Clyno Engineering Co. November 21st, 1917. (119,745.)

17,930. Electromagnetic clutches. A. Soames & W. Langdon-Davies. December 4th, 1917. (119,754.)

18,080. Electric induction coils for medical purposes. E. E. Greville. December 6th, 1917. (119,756.)